ELECTRONICS Australia

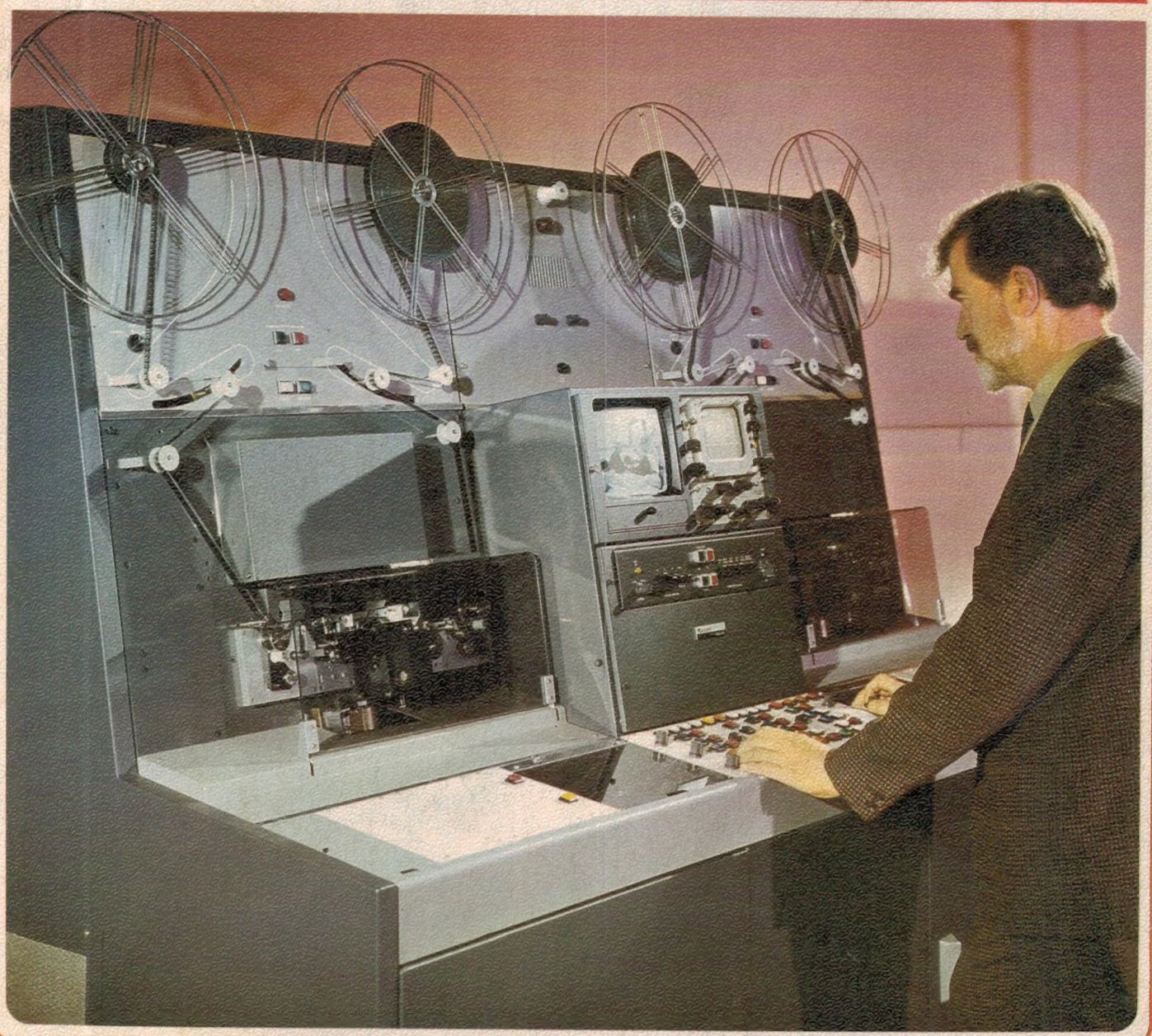
NOVEMBER, 1973

New Zealand 75c

60c*

Registered for posting as a periodical — Category B

CABLE TV: PRESENT & FUTURE * MORE ABOUT HI-FI TRENDS * BUILD A CASSETTE PLAYER



Dawn of a new deal in Sony super sound

When the tingling tonality of Sony's super stereo amplifier TA-1150 teams with the TC-377 tape deck the sound that surges through the Sony DR-11 headphones is guaranteed to totally enchant your eustachian tubes.
There's 30W (RMS) per channel from the gleaming TA-1150 for all the power you could reasonably need. Every desirable feature and input. The TC-377 has Sony's precisely engineered Ferrite and Ferrite heads for amazingly long life, new servo-controlled tape back tension regulator, 3-lead system and auto shut off. Frequency response is 20Hz-30kHz. The DR-11 stereo headphone comes in yellow or black, has built-in tone and volume control, even a mono-stereo switch. If you want speakers you can choose from Sony's incomparable Ultra-Linear enclosures from the convenient SS-7200 to the mighty SS-7600. What's so special about all this? It's a Sony system at a most competitive price. And that's more exciting than the sun coming up. Ask your Sony dealer.

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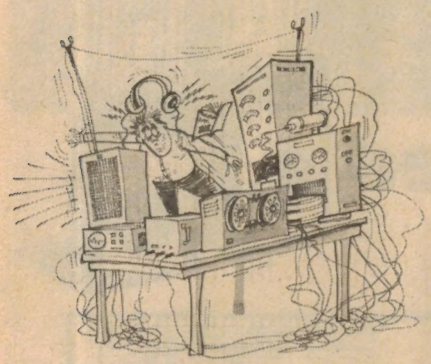
ELECTRONICS Australia

Australia's largest-selling electronics & hi-fi magazine

VOLUME 35 No 8

Cable TV may not be big business in Australia as yet, but it's coming. In this issue we present the first part of a special report on the way cable TV is shaping up in the USA. It starts on page 20.



Are you one of the many who have been vainly trying to get good reproduction from a low cost cassette deck? If so, our new preamp design should be of special interest. See p.34.

On the cover

Operating the new Marconi type B3404 colour telecine suite, whose camera chain is derived from the MkVIII automatic camera. The projector mechanisms feature instant start, automatic loop forming and restoration, and continuous speed variation from 1 to 45 pictures per second in either direction. (Courteay AWA Ltd.)

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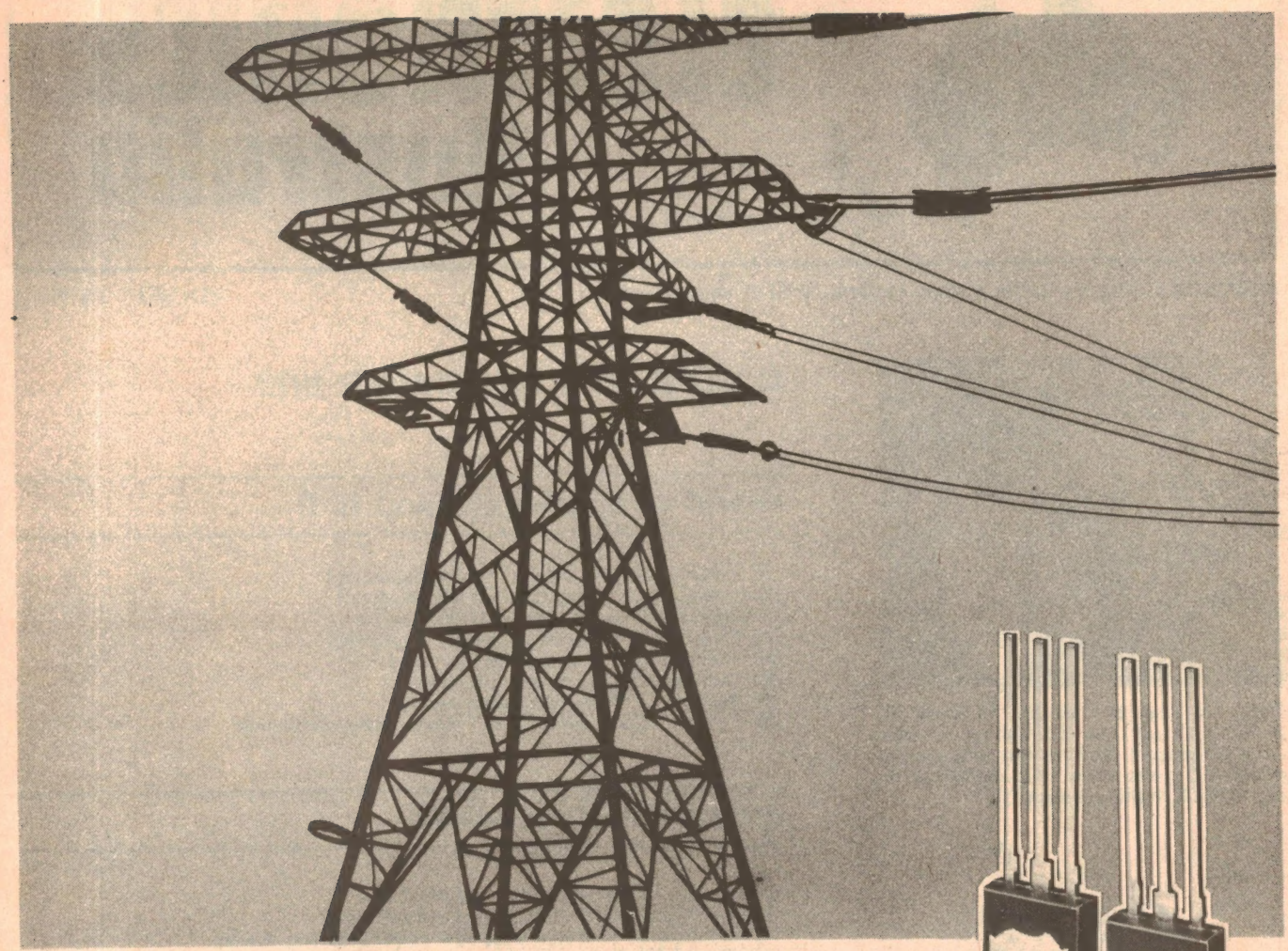
world of electronics and hi-fi

projects and technical

regular features

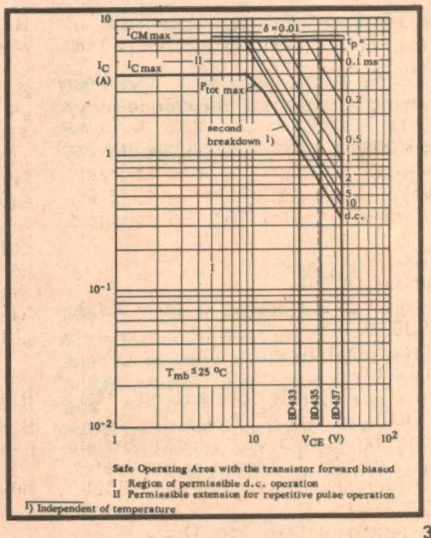


Power problems solved
(in a small package)

Elcoma introduces its new range of flat pack power transistors.

Type No. NPN	PNP	V_{CEO} (V)	I_{CM} (A)	I_C (A)	Ptot up to $T_{mb} = 25°C$ (W)	hFE	@ I_C (A)
BD135	BD136	45	1.5	1.0	8*	>25	0.5
BD137	BD138	60	1.5	1.0	8*	>25	0.5
BD139	BD140	80	1.5	1.0	8*	>25	0.5
BD233	BD234	45	6	2	25	>25	1.0
BD235	BD236	60	6	2	25	>25	1.0
BD237	BD238	80	6	2	25	>25	1.0
BD433	BD434	22	7	4	36	>50	2.0
BD435	BD436	32	7	4	36	>50	2.0
BD437	BD438	45	7	4	36	>40	2.0

*up to $T_{mb} = 70°C$

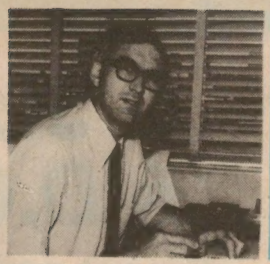


Safe Operating Area with the transistor forward biased
I Region of permissible d.c. operation
II Permissible extension for repetitive pulse operation
1) Independent of temperature

38.2185

ELCOMA

ELECTRONIC COMPONENTS AND MATERIALS
Sydney, Melbourne, Brisbane, Adelaide, Perth



EDITORIAL VIEWPOINT

The FM inquiry — good news or no?

Since my last leader was written, the Federal Government has announced that it will hold a further inquiry into the establishment of an FM radio service, as recommended by the Senate select committee on Education and the Arts. And to be consistent with my sentiments expressed last month, I suppose I should be enthusiastic.

What worries me is that there are indications that the inquiry may be little more than a political exercise, with its findings a foregone conclusion.

Certainly the Minister for the Media stressed that the inquiry should look into the socio-economic implications of establishing an FM service in either the VHF or UHF bands, and not just at the technical factors affecting a choice between the two bands. But in contrast with this, the Prime Minister said that the inquiry "would have regard to the Government's wish to establish FM radio as quickly as possible."

By the sound of this, the inquiry is unlikely to be able to make a thorough and comprehensive investigation into the full socio-economic implications of establishing a full-scale FM service in Australia. It looks as if the fundamental question of what scale of service Australia can justify and afford has already been pre-judged by the Government. The only real task performed by the inquiry will probably be to suggest the best timetable and spectrum allocation.

It will be all the more futile if it penetrates no further than the opinions already expressed and re-expressed by those interests closest to the question.

On a more cheerful note: in this issue we present the first of a series of four articles on the development of cable TV in the United States, by noted writer Les Rich. The series should make fascinating reading for anyone interested in the social implications of technology. Although the pressures for community-access television have not become significant in Australia as yet, they will no doubt build up here as elsewhere.

One thing to bear in mind when reading the series is that CATV is not the only way, nor the cheapest way, of providing community-access TV. Low power UHF transmitters also have their place, although this approach does not have the same potential for viewer "feedback."

— Jamieson Rowe

ON SALE THE FIRST MONDAY OF EACH MONTH.

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IM Distortion: Less than ½"% — 400 & 4000 Hz at 14.3 cms / sec. recorded velocity
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ADC 550XE ... $27.00

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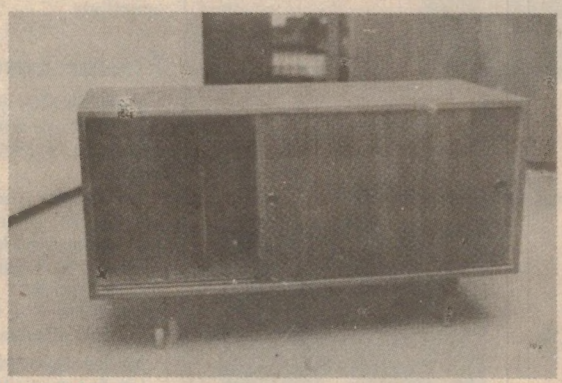
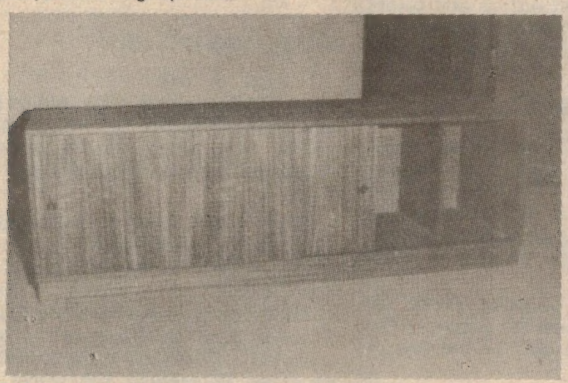
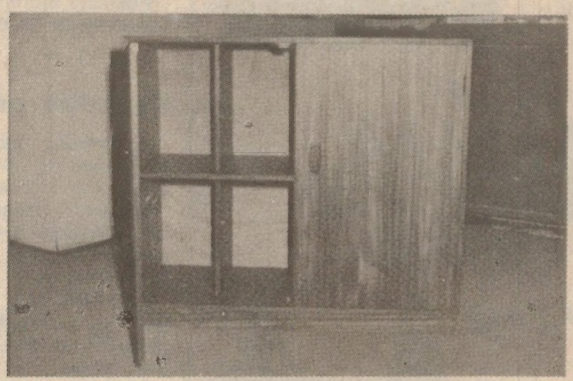
A neat general purpose unit, designed to carry between 80 and 100 records, it measures 23¾" x 14" (high) x 14½" (deep). Kit price is $29.50 (teak or walnut veneer). Normally comes with base, but 4½" legs optional.



MODEL RS No. 2
A larger unit measuring 35½" x 14" (high) x 15¾" (deep), the kit is priced at $45.00 (teak or walnut veneer). Normally comes with base, but 4½" legs optional.



MODEL RS No. 3
This model measures 51¼" x 14" (high) x 15¾" (deep) and is priced at $49.50 (teak or walnut kits). Normally comes with base, but 4½" legs optional.



MODEL RS No. 4
This attractive model is aesthetically styled with full height opening doors and recessed handles cut from solid teak. With two record storage shelves, one on top of the other, and ample vertical dividers, the unit measures 35¾" x 31½" (high) x 16" (deep). Kit price is $65.00 (teak or walnut veneer).

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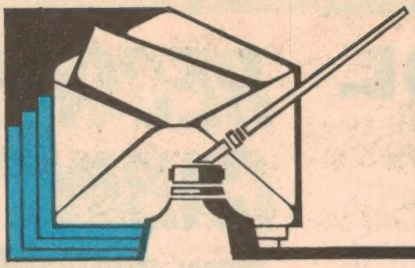

LETTERS TO THE EDITOR

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their protential interest to readers and to abbreviate their contents where this appears to be appropriate.

Power cords

Periodically your writers refer to the incorrect re-wiring of power cords on domestic appliance plugs and extnesion leads.

My observation indicates that this faulty wiring is most often done by motor mechanics and is due to their convention of calling the black wire the 'earth', not appreciating that it is not really an earth connection but is the neutral return that uses the chassis as part of its circuit.

In the three-wire domestic cord the black wire is again the neutral return, while the green covered wire and pins marked 'E' are true earth connections and not part of the electrical circuit at all.

Possibly motoring institutions and tutors should begin to correct their terminology.

K. Roff (Griffith, NSW.)

Cascode problem

A certain technical query has been exercising my meagre wits off and on for some 15 years now. It has to do with the traditional circuit of a series connected cascode radio-frequency amplifier stage, as frequently used in TV receivers, VHF converters etc.

In particular, I am puzzled about the inductor normally connected between the plate of the first triode and the cathode of the second.

In the great majority of literature, and in all ARRL literature, it is described as a neutralising coil. Indeed the adjustment procedures given in relation to it are always those appropriate to a neutralising circuit. But I fail to see how it neutralises anything.

Presumably only the first (grounded-cathode) section requires neutralising. How can this be achieved by a circuit that is connected to only one active electrode? Surely any neutralising circuit must be coupled to two active elements in the stage being neutralised?

In TV tuners, this inductor is not band-switched along with the majority of other inductors. Presumably the inductor should really be changed to maintain a neutralised condition over the TV spectrum from 45 to 210 odd MHz and yet this is not done.

Some text books on TV receiver design call the item a "peaking inductor," implying that its function is to maintain overall gain at the higher frequencies, where gain would normally be expected to drop. Something after the manner of a video peaking coil in a video amplifier.

In most of the RSGB literature they remain very cagey about the inductor, suggesting in some cases that it should be "adjusted for optimum noise figure"; in other cases they describe neutralising circuit type adjustments.

In one RSGB publication, the "VHF-UHF manual" by G. R. Jessop it is called a "matching coil" (Chapter 7, page 7).

So there we have at least three explanations, none of them very convincing to me, especially since I have omitted the coil completely in numerous converters for the 50, 52 and 144MHz bands. Admittedly, I have noticed that circuits without the coil are sometimes more prone to instability.

Can you offer an explanation for this inductor? Or is it a scheme by vested interests to sell more copper wire?

A.C. Rechner (Crystal Brook, S.A.)

COMMENT: We agree that the particular circuit element seems to have received scant attention in the literature. How many have seen a detailed analysis of its function?

Buy Australian!

I wish to refer to "D.B." (Carlton, Vic.)'s" letter which appeared on page 61 of Electronics Australia's September 1973 edition and which expressed concern at delays in obtaining spares for an "imported CRO".

If the writer would care to contact me I would be more than delighted to discuss with him the advantages he would obtain by purchasing a wholly Australian manufactured, fully guaranteed and backed Cathode Ray Oscilloscope — which incidentally is also exported to more than 30 countries throughout the world including the United States of America.

L. R. Riggall,
National Marketing Manager.
B.W.D. Electronics Pty Ltd.

Loudspeaker matrix

As you are no doubt aware, your simple 4-channel "ambience" speaker set-up (HiFi-Stereo Annual p 105) also gives excellent results in decoding regular matrix (RM) or QS encoded records. Results on SQ encoded records are not so good.

Analysis of the recommended system of SQ decoding has convinced me that provision of a switch to reverse the phase of the righthand rear loudspeaker will provide reasonably accurate decoding of these records.

Practical tests on my own equipment and also that of a friend (whose gear is more elaborate and expensive than mine) have proved the theory correct.

I have already built a proper SQ decoder round the MC1312P integrated circuit so have a reliable standard of comparison.

Two points arise:

(1) Rear loudspeakers should preferably be similar in sensitivity to the front speakers for optimum effect.

(2) Placement of rear loudspeakers should be the subject of experiment.

Give the idea a trial. It will only take a few minutes to hook up. The CBS-Sony disc "Switched-On Bach" (Moog Synthesiser) is a good test.

H. Swan.
(Bulimba, Qld).

COMMENT: We haven't done any more with a loudspeaker matrix since those articles appeared and we can't comment on your findings. Other readers may care to "give it a go!"

What's in a name?

Mr Cushen's DX notes for August tell us that Papua New Guinea is about to change its name to what he calls "The Pidgin version — New Gune". This is incorrect.

For a start, the phonetic rendition of New Guinea as usually employed in written Pidgin is Nugini or Niugini. In any event, it is not the name of the country either now or after self-government in December. It is a part.

The name of the country is Papua New Guinea (three words, no comma, no hyphen), and this is the name under which it will enter self-government. No immediate change is projected.

Several years ago a parliamentary committee recommended the name Pagini as an attempt to combine the elements of Papua and New Guinea, but the recommendation was not acceptable to the House of Assembly.

Your own front cover style until recently of indicating "Price in New Guinea" when you really meant "Price in Papua New Guinea" is offensive to most people who live in Papua and many who live in New Guinea. It's like saying that New South Wales is the same thing as Australia.

A. Smales
(Konedobu, PNG)

Plastic transistors

I wish to advise that Kit-Sets Aust will not, in future, be stocking transistor types BC107, BC108, BC109 and will be supplying an alternative plastic encased type BC547, BC548, BC549 which are in the T092 package. It would be appreciated if you would publish the pin connections and alternative type numbers in future.

The reason for the change, I think, is quite obvious. The main one being lower priced semi-conductors to our customers and, of course, your readers.

Gary Worth,
Sales Manager.

Cat nap

I should like to recommend, through "Electronics Australia", to the manufacturers of Innerbond a new use for their acetate fibres.

Our small Siamese cat has fully approved of a remnant of Innerbond lining a shoe box!

Yours (since 1939)
J. H. A. Clark (Harbord, NSW).


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THE QUAD THEY COULDN'T STOP
THE AMP OU'LL NEVER FORGET
NOW IT CAN BE TO

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All Australia is cheering.

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A new and inexpensive quad. Bold. Daring. The most complex product in the line. Sophisticated enough to be used with a low voltage power supply and still eliminate the need for dual supplies. It is compatible with all forms of logic and can operate over wide voltage supplies.

Amazing performance.

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Unbelievable, but true. The new comparator that's compatible with all forms of logic and is the only device suitable for interfacing with CMOS logic. More kudos. It's the only comparator that can be supplied with two millivolts guaranteed. It operates from a single supply which means it may be powered by batteries.

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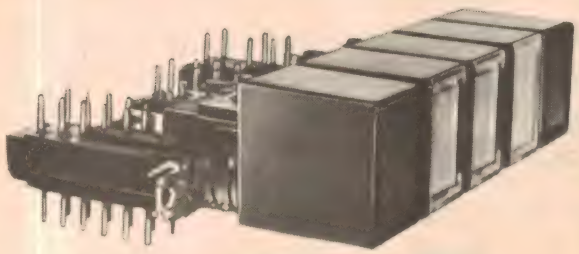
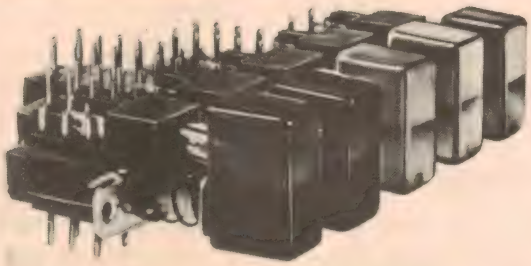
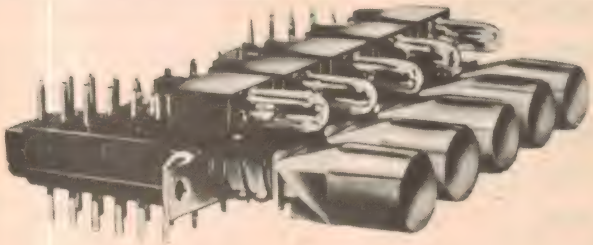


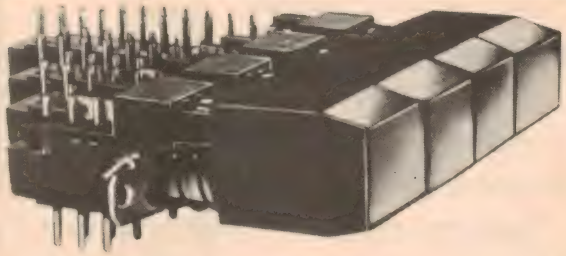
Style 2.
Button with snap-in lens 15 m.m. pitch.



Style 3.
Integral button frosted for maximum light dispersion 10 m.m. pitch.



Style 4.
Round button with rear prism for maximum light transmission 12.5 m.m. pitch.



Style 5.
Button with three sided snap-in lens 15 m.m. pitch.

Yes, we now have four NEW styles of Illuminated Push Buttons to suit the well known Isostat push button switch range.
You can make your choice of the exact style of illuminated buttons to complement your equipment styling.
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By proven vibration-proof incandescent wedge-base lamps.
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Illuminated button pitch spacings; 10 m.m., 12.5 m.m. and 15 m.m.
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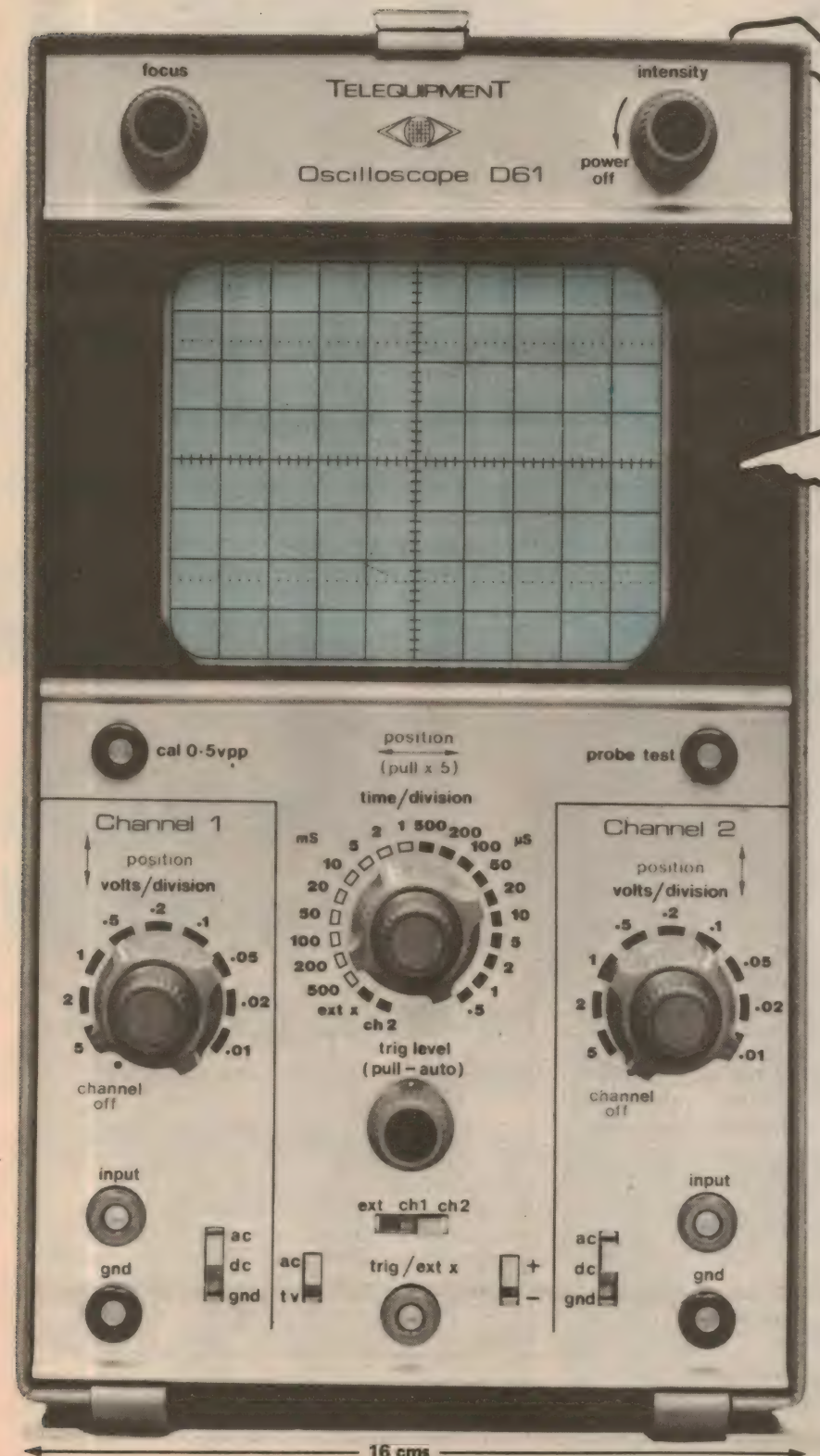

Tektronix have released this new D61 model in their **Telequipment** range. It's been specially designed for general purpose laboratory, educational and colour T.V. servicing applications. And its only

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The D61 is a 10MHz dual trace oscilliscope featuring rugged, all solid state construction.
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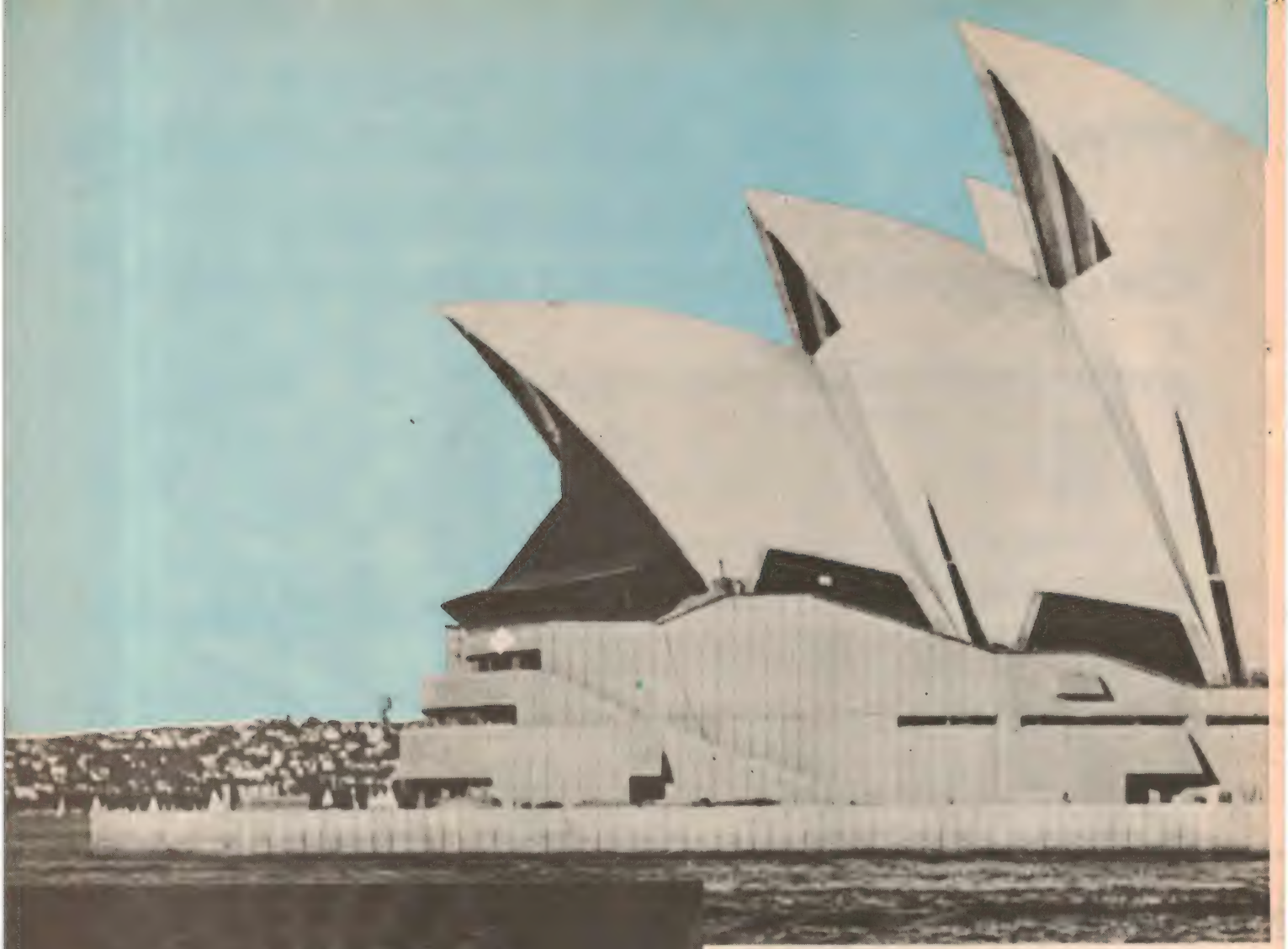

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NEWS HIGHLIGHTS

Single tube colour TV camera from RCA

A new colour TV camera tube which makes possible very small single tube colour TV cameras suitable for live or film pickup was featured by RCA Electronic Components at the 1973 International Exhibition of Electronic Components, held recently in Paris.

The new camera tube, called the SpectraPlex vidicon, incorporates integral dichroic filter stripes on the faceplate to optically encode the colour information. In addition, the tube incorporates the familiar vidicon structure, uses magnetic focus and deflection, and requires only moderate studio lighting. These features should make the tube especially suited for instructional and industrial closed circuit TV and cable TV systems.

The SpectraPlex signal can be either NTSC encoded or PAL encoded and, as well as providing full colour video information, the system will also produce fully compatible video for black and white monitors.

RCA's SpectraPlex vidicon, RCA-4445 (formerly Developmental Type C23189), differs from the standard type of vidicon camera tube in that the faceplate is coated with two sets of dichroic filter stripes, each having suitable colour transmission characteristics, alternated with clear transmission areas. This filter stripe matrix is used to automatically encode the colours of the televised scene into a single video signal from the camera tube. The miltiplexed red and blue colour (chrominance) signal components, together with the broad band luminance (or brightness) component from the clear areas, provide all the information necessary to reconstruct a full colour picture within the framework of any standard electronic system.

More specifically, the SpectraPlex vidicon generates coded colour information for subsequent processing in the following manner. As the electron beam scans the target, certain well-defined carrier frequencies will be generated from the filter stripes imaged on to the target area. With proper orientation and scan size, the blue carrier frequency generated from the vertical (yellow) stripes will be 5.0MHz, while that generated from the cyan 45-degree stripes (red carrier) will be 3.5MHz

The carrier frequencies will be amplitude modulated by the variable brightness of two primary colours and the pattern produced by the televised scene imaged on the photoconductive target. In this final form, it is possible to selectively transmit these colour carriers and a broad band luminance signal into a decoding amplifier matrix to obtain the individual red, blue, green and luminance signal elements necessary for the chosen transmission encoder.

NASA develops temperature pill

A small radio transmitter pill which, when swallowed, can monitor deep body temperatures has been developed by NASA scientists.

Designed at Ames Research Centre, California, the pill has been used to monitor persons in an environment simulating travel in a spacecraft. The advantage of the device is that it allows the body temperature to be monitored continuously over a 24-hour period on a day-by-day basis; a task difficult to accomplish by other presently available methods.

The miniaturised transmitter can detect very small variations in temperature during its passage through human alimentary tracts. Localised temperature rises may often reveal the presence of infections or other disorders, and may provide doctors with useful diagnostic data.

The pill transmitter, which is about the size of a vitamin capsule, can be easily swallowed. It is coated so that it will not dissolve while passing through the digestive tract. The trip usually takes a minimum of two days, or can be as long as one week if a low residue diet is prescribed. Its principal advantage lies in the fact that it does not require any wires to be attached to the body surface, nor does it require conventional inserted instrumentation such as oral or rectal thermometers or thermistor probes.

Because of its small size, the pill transmitter only has a very limited range. It is used most easily in situations where the subject is placed in a confined environmental situation, such as a hospital. The effective range of the pill transmitter can be improved by employing a second device to retransmit the signal. This device is about the size of a cigarette lighter and is designed to be carried in the patient's shirt pocket. It has an effective transmission distance of approximately 100 feet.

The pill transmitter concept is not limited to reporting temperatures. It can be used to record and transmit other internal data in humans. The temperature sensing unit could be replaced by a monitor sensitive to stomach acidity, intestinal pressure, or to specific chemicals in the gastro-intestinal tract. With continued technological advances in miniaturisation, engineers are confident that as many as five factors can eventually be measured simultaneously by a device no bigger than an aspirin tablet.

At present, each pill is hand made for research purposes, and costs $110.00. Engineers predict that, by utilising mass production methods, the price could be reduced to 50 cents. Efforts are continuing to decrease the size of the pill and to increase its transmitting power, without increasing its cost.

Weather satellite monitors rainfall

A new weather satellite launched recently by NASA is filling a critical gap in man's understanding of his environment, by measuring the daily distribution of rainfall over the oceans. The water vapour measurements are performed by an Electrically Scanning Microwave Radiometer (ESMR) carried by Nimbus 5, which was launched last December from the Western Test Range, Lompoc, California.

The intensity of a storm, or even a potential storm, may be related to the amount of energy released in the area by the process that causes rainfall. A knowledge of rainfall rates, and the amount of heat thus produced, will be of immense value in reaching the goal of long range weather forecasts, as well as improving short term forecasts of severe phenomena such as hurricanes.

Interpretation of the false colour photographs obtained from the new weather satellite is a skilled process. Different colours on the photograph relate to different sets of physical parameters on the ground (eg ground temperatures, moisture distribution patterns). Dark blue portions of the globe indicate that the atmosphere is somewhat dryer than for the light blue areas. Black sections extending away from the equator represent very dry regions with no clouds and low humidity.

Global land masses are easily recognisable through cloud cover. However, the colour contrasts that are clear indications of atmospheric moisture content over the oceans are more ambiguous over land. Here, the emission of microwave radiation is affected by the surface temperature, soil moisture, vegetation, and surface roughness.

Teldec video disc

A simplified colour TV disc playback system has been developed by Telefunken-Decca. Known as TED, the new unit is connected to an ordinary TV set by simply plugging it into the antenna socket. Reproduction is from a paper thin disc, via Teldec's stylus pickup. The disc, which measures 21cm in diameter, runs for about ten minutes. It is pliable, is capable of being quickly and cheaply produced, and can be included as an advertising supplement in newspapers and magazines.

A disc-changing unit has also been developed and will be introduced in the near future. This will enable the new disc pickup system to reproduce full length plays and feature films. Discs are fed into the replay unit together with their sleeves. The unit separates the disc from its sleeve and, after the disc has been played, replaces the sleeve and ejects the disc. A break in the program material of about five seconds duration occurs between disc changes.

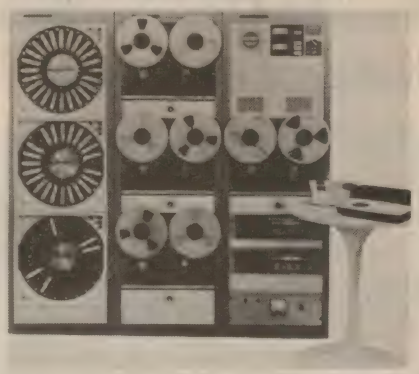
Deliveries of TED units are scheduled to begin in West Germany in Januay, 1974, and Scandinavia is to be supplied shortly after that date. Teldec, the jointly owned subsidiary of AEG-Telefunken and Decca, will supply the British market at a date to be determined.

TELDEC predicts that it will have about 160 different discs in its first record catalogue.

Schafer radio automation system

Designed to meet the full operational requirements of any radio station, the Schager 900 series of radio automation systems offer partial or complete automation for station operation. The equipment can be programmed to switch automatically between pre-recorded material and live broadcasts.

The Schafer radio automation system utilises material which has been pre-recorded on either reel-to-reel tapes or tape cartridges which are stored in carousels. Programmes are selected by a solid state memory unit, and may be selected on either a time basis or a sequential basis.



High power lasers used in nuclear research

Nuclear fusion, the basic reaction by which the sun converts matter into energy, requires temperatures of 100 million degrees to enable the fusion process to take place. These temperatures have been produced in the past by nuclear fission reactions. However, this method is unsuitable for the production of thermonuclear energy for peaceful purposes.

The potential use of high power lasers to initiate controlled thermonuclear fusion reactions is currently under study at the College of Engineering and Applied Science, University of Rochester.

The research project operates under the jount sponsorship of the University, General Electric, Esso Research and Engineering Company, and Northeast Utilities.

It is considered that thermonuclear energy will ultimately help to fill part of the increasing demand for electric power in the United States.

Dr Leonard M. Goldman adjusts instrumentation on the target chamber within which fuel pellets of deuterium or lithium deuteride will be heated and vaporized by bursts of light from a high power laser system.

Improved hotel communications

Noah's Hotel in Exhibition Street, Melbourne, has installed an illuminated switch system to improve communications between the reservation desk and the hotel housekeeper. The new system informs the reservation desk as to the status of each room in the hotel and indicates to the hotel housekeeper when a room has to be serviced.

A control panel containing 292 sets of McMurdo "Isostat" push-button indicator switches is situated at the reservation desk. Each set of switches has three illuminated buttons which light up when the button is pressed. These buttons are colour coded as follows: red (when the room is occupied), orange (indicating that the last guest has checked out and the room has to be fully serviced), and green (indicating that the room has been serviced and is ready for "sale").

An identical panel is situated in the housekeeper's office on the tenth floor.

When a guest checks out, the reservation clerk presses the orange button for that room. This illuminates the orange button for that room at both the reservation desk and in the housekeeper's office, indicating that the room has to be serviced. Once the room has been serviced, the housekeeper cancels the signal on the orange button and then presses the green button to indicate that the room is vacant and serviced. When the room is "sold," the reservation clerk cancels the signal on the green button and presses the red button which illuminates to indicate that the room is now occupied and requires daily servicing.

The system was made and installed by L & M Electrics Pty Ltd, Surfers Paradise, Queensland.

NEWS HIGHLIGHTS

Philips VCR records operation

Technicians from Philips Vision and Sound Division recently recorded, in colour, a hip arthrodesis operation performed at Liverpool Hospital in NSW. The operation was performed by New York specialist Dr Howard Rosen, who was in Sydney to attend a medical conference. It was the first time that an orthopaedic operation using the compression method had been performed in Australia.

The compression method of repairing bone fractures and displacement is a Swiss technique based on the research and experience of the Association for the Study of Internal Fixation. The procedure involves the use of metal plates and compression jacks to push and hold the bones together. It enables the bones to knit and allows the patient to begin moving the affected limb immediately after the operation. Conventional plaster casts, which may cause stiffening and waste of muscle, are not necessary.

The patient involved in the operation at Liverpool Hospital underwent surgery for a damaged hip joint. The ball part of the hip had softened, and had come away from the socket. X-rays were sent to Dr Rosen in New York, and he decided that the compression method would be the most effective treatment. Furthermore, Dr Rosen agreed that the operation could be recorded on videotape cassette. He had previously taken part in similar recordings of operations at Mt Sinai School of Medicine in New York where he is an Associate Clinical Professor of Orthopaedic Surgery.

On the day of the operation, Philips technicians installed a television camera equipped with a telephoto lens in the operating theatre. Dr Rosen wore a microphone, and his explanation of his technique was recorded on sound track.

A Liverpool Hospital spokesman said that the recording was most valuable because it was in colour. "In black and white it would have little relevance to the actual operation," he said. "The video cassette recording also has the advantage that, by simply pushing a button, the tape can be stopped to view any part of the operation."

Medical schools, too, are finding video cassette recordings a valuable addition to libraries. At Monash University a cancer operation was recently recorded on a Philips VCR and edited for use for future study. In this way, medical students can study the surgical techniques at their own pace and can play back sections of the tape which require additional viewing.

Digital electronic watch has LCD

A new range of solid state digital watches from Microma Incorporated has recently been released in Australia.

The Microma watch is totally solid state and has no moving parts. It is timed by a 32kHz quartz crystal together with a CMOS integrated circuit. A liquid crystal display is used to show the exact hour and minute. The unit is powered by a 1.5V silver oxide battery which lasts for approximately one year.

Microma Incorporated is represented in Australia by Anderson Digital Electronics Pty Ltd, PO Box 322, Mt Waverley, Victoria 3149.

Britain-China telex

A telex service has been established for the first time between Britain and the People's Republic of China. It began operation on September 1st.

Calls to China will be connected manually by the international telex exchange in London. Telex users wishing to contact China are first required to dial 201 and then key to the operator the name of the country, town, and telex number required.

Telex calls to China will go by one of three routes to Hong Kong, then by a radio system to Peking. The routes, which are selected automatically, are: by submarine cable across the Atlantic to the USA, and then by satellite over the Pacific; by submarine cable across the Atlantic to Canada, across Canada by microwave link, and then by another submarine cable across the Pacific; and from the Post Office earth station at Goonhilly, Cornwall, then by satellite over the Indian Ocean direct to Hong Kong.

There will be a minimum charge of £3.75 for the first three minutes of each call, and each additional minute will cost 1.25.

Earlier this year, China agreed to the use of British Post Office telephone credit cards for telephone calls from China to the UK. This has enabled British businessmen and travellers in China to make telephone calls to the UK without having to pay for the call at the time the call was made. The cost of the call is simply billed to the subscriber's telephone number in Britain. At the same time, China also agreed to allow transferred-charge calls to be made from China to Britain, and to accept transferred-charge calls from Britain to China.

The telephone service with China operates for three hours daily between the hours of 0800 and 1100 hours GMT (0900-1200 BST).

Spare satellite

A new $6m communications satellite, launched from Cape Kennedy, Florida, on August 23, 1973, has been successfully manoeuvred into a stationary earth orbit, 22,300 miles above the Atlantic Ocean.

The satellite, capable of handling up to 5,000 telephone conversations simultaneously, has been provided as an orbiting "spare" for the busy transatlantic telecommunications network, where two satellites are already carrying 5 million calls a year between Britain, North and South America, Africa, and the Middle East.

Approximately half of the international calls between Britain and North America now go by satellite so that safeguards against a satellite failure are vital. The new satellite, is designed to take over in the event of a malfunction in either of the two operational satellites, thus ensuring continuity of service for this important communications link.

Four INTELSAT satellites now provide the world with communication on a global scale. Two of these are working 22,300 miles over the Atlantic while the others are positioned over the Pacific and Indian Oceans. They are provided and operated by INTELSAT, the 83-nation organisation of which the UK (through Post Office Telecommunications) is the second largest shareholder.

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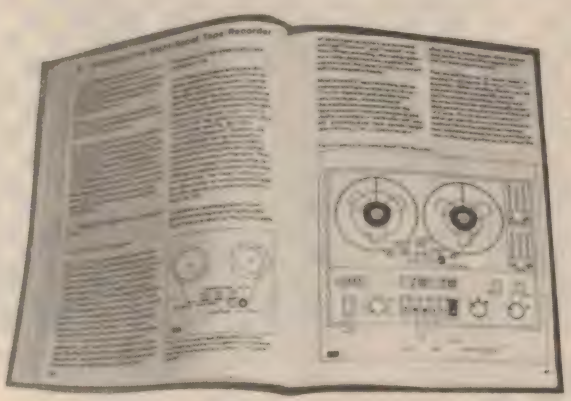

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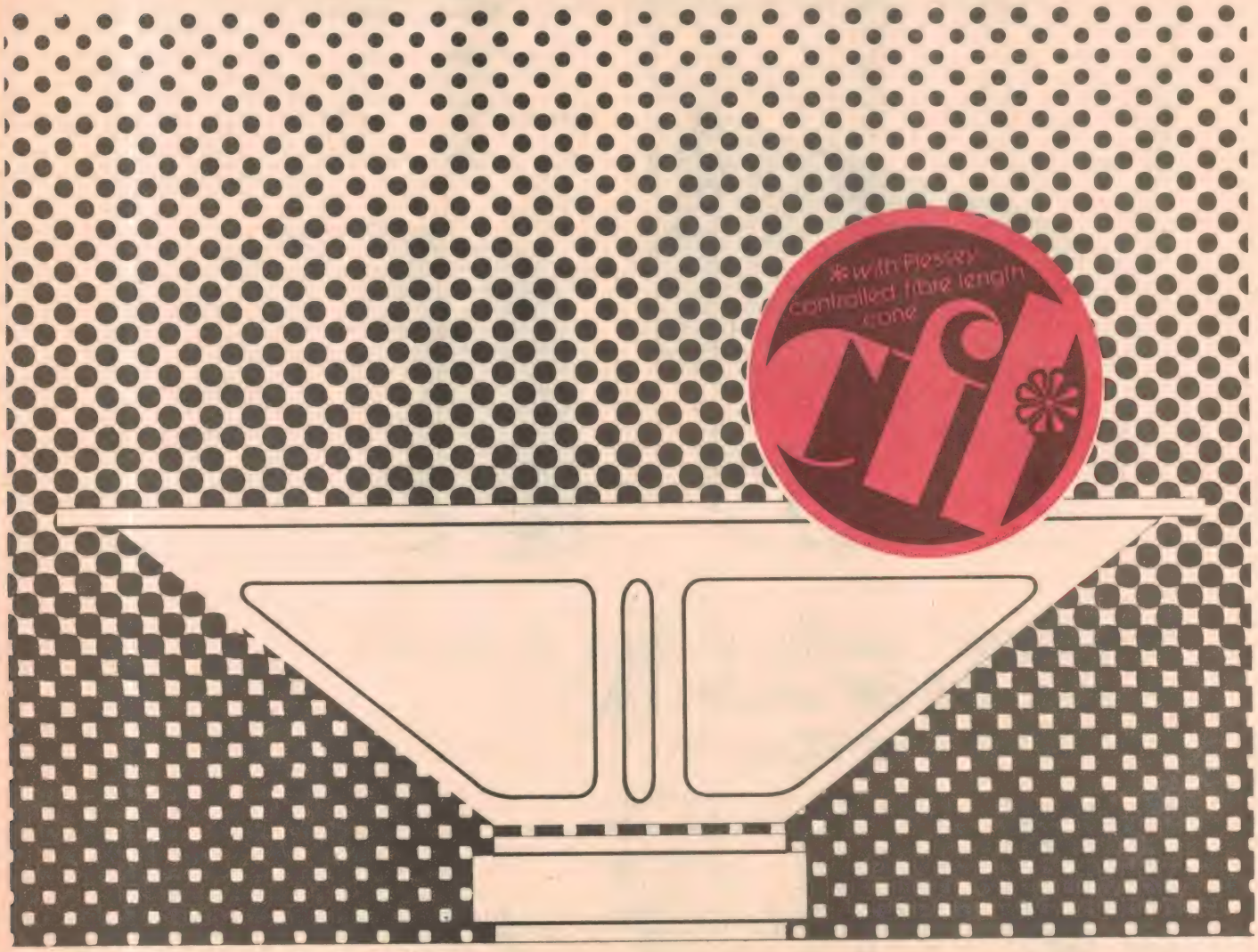

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NEWS

CCD camera

Fairchild Camera and Instrument Corporation has developed a solid-state monochrome TV camera that has an area array of 10,000 CCD elements as its basic sensor. Designated the MV-100, the new camera has several unique features which are made possible by the use of charge-coupled devices — low power consumption, small size, and the capability to operate over a broad range of light conditions.

The MV-100 camera has not been designed to meet television broadcast standards. Instead, Fairchild is aiming it at the less stringent requirements of process control, medical instrumentation, and surveillance. The company predicts that future CCD cameras will have a significant impact on the closed-circuit and broadcast television industries, and that they will eventually replace vidicon-tube TV cameras.

The new CCD camera measures 3½ x 1½ x 2¼ inches and weighs six ounces. Power consumption is 1W, from either the 115-volt AC line, or from a battery pack using 12V rechargeable silver-zinc battery that will last for about three hours.

Horizontal and vertical scanning frequencies employed are 15,750 lines / sec (as for a standard US broadcast camera) and 120 frames / sec respectively. The vertical scan rate is four times higher than the standard of 30 frames per second. This is because the CCD camera does not produce enough resolution elements to fill up a standard TV monitor. It produces about 80 TV lines per picture height, compared with 525 lines in a conventional broadcast camera.

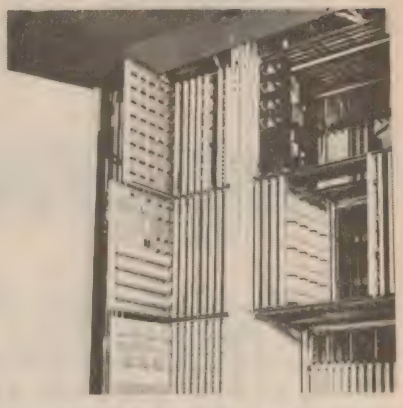
The active sensor, which is contained in a 24-pin dual in-line package, consists of 10,000 elements in a 100 x 100 array. Each column of 100 light-sensitive elements is interspersed with a column of opaque CCD storage elements. The CCD sensors have been fabricated in bulk-silicon material that releases charge carriers in proportion to the amount of light reflected from the scene.

Computerised telephone exchange

The Netherlands PTT recently passed an important milestone in their far-seeing program for modernising the country's telephone service. This important step took place on February 7th of this year when the first assembly-line produced stored program controlled (SPC) telephone exchange, type PRX, was officially inaugurated at Utrecht, after having been on trial operation since the end of 1972.

SPC exchanges are superior to conventional exchanges in many ways: they are more reliable, easier to install and maintain, better suited to mass production techniques, and require 50 to 70 per cent less floor space. Moreover, the use of computer logic creates extra facilities that can be employed for better management control and for an improved service to subscribers.

The SPC system will make it possible to incorporate a rationalised service policy, with the result that operating and maintenance staff will be able to simultaneously supervise several exchanges whilst based



at one centralised station. Maintenance tasks are further simplified as faults are indicated by the equipment itself. The location of these faults is carried out according to standardised diagnostic programs.

Slow memory unit for TV subtitles

The Engineering Designs Department of the BBC has designed a slow memory unit for TV subtitles. Claimed to be half the cost of the cheapest suitable disc system on the market, the new memory is built around a sheet of magnetic tape material stretched over a phonograph turntable.

The new unit is eminently suitable for superimposing subtitle material on a TV screen (eg. players' names, an event-winner's time, the game score etc). Primary objections to existing methods are that magnetic tape will not give fast enough access, and an off-the-shelf disc store will give faster access and more capacity than required. The price of such a unit will therefore include the cost of unwanted features. These objections have been largely overcome by the design of the new slow memory unit, the physical construction of which is comparatively simple in concept.

A magnetic sheet is stretched across a circular frame which is mounted on a standard Garrard 401 turntable rotating at 78rpm. The oxide coating on the magnetic sheet is mounted facing downwards. A single read / write head, moved radially by a stepping motor, is carried by a fixed radial arm. The head is in permanent contact with the magnetic sheet, thus maintaining the head-to-oxide clearance at the sheet thickness (about 0.5mm).

Design specifications of the new unit include the use of 16 diaphragm tracks (and, therefore, 16 head positions) each of which is divided into 16 segments thus providing the 256 separate storage spaces. Segment divisions are marked by sixteen equally spaced holes drilled around the turntable. These holes are located by a light-emitting diode and photocell arrangement.

Each segment holds about 400 bits including start, finish, and line-feed characters, as well as the 256 character bits. The packing density varies according to the distance of the track from the centre of the diaphragm and is between 250 and 400 bits per inch. This allows a constant bit transfer rate of 8,192 bits per second to be used.

Police computer keeps tabs on vehicles

A stolen motor vehicle, a hit-run driver, an abandoned car, a multi-car accident; these are just four fairly common reasons why the police may wish to obtain details of the registration of a particular motor vehicle as quickly as possible.

In NSW at present all such police enquiries have to be made by telephone calls to the NSW Department of Motor Transport, Roseberry, the information manually recorded, and then passed on to the police requiring the information.

By the end of this year, or early next year, the NSW Police Department will be hooked up to the Department of Motor Transport's computer, enabling the Police Communications Centre to obtain both visual display of information or hard copy printouts in a matter of seconds.

The terminal units, which will shortly be installed at the Stolen Motor Vehicles Index (SMVI) office and the Police Radio Centre, will be linked to the computer by copper-covered steel-core coaxial cable supplied by Austral Standard Cables Pty Ltd of Liverpool. The cable, which has been manufactured to an American military specification, has a helical thread of polythene and is in a polythene tube braided over with plain copper wire.

Once the terminal units are installed, the SMVI will have two VDUs (Visual Display Units) and one hard copy printout, and the Radio Centre one VDU and one printout. All Sydney metropolitan police telephone enquiries will be handled by the SMVI and all metropolitan radio queries (from mobile patrols) by the Radio Centre.

Country enquiries will come in either by telephone or by telex. The police telex network is being greatly extended and will soon link all country "Inspector Stations" with Sydney. For example, Bathurst, Orange, Broken Hill, Albury, Gosford and Grafton will all be in the telex network by the time the terminal units have been installed in Sydney.

Initially, the information available will relate only to vehicle registration. This information has already been computerised by Department of Motor Transport data processing staff. The next two phases of conversion to computer systems will take in all details of drivers' licences and, later, traffic conviction records.

The entire Master Vehicle File of the NSW Department of Motor Transport, which covers some 2,350,000 vehicles and lists such details as plate number, make, model, body weight, horsepower and insurance classification has also been computerised. In computerised form, this mass of information is just four computer disc packs each of which is kept continually "on line" for instant access to details.

The Department of Motor Transport's IBM Model 370 / 145 Computer has 14 disc drives at the moment and this will shortly be increased to 18, providing a total capacity of 1800 million information characters.

Cable TV: the long awaited dream

The introduction of cable TV (CATV) systems in the United States has not been without its problems — problems which, as yet, are far from being solved. Nevertheless, the concept of the "plugged-in nation" is moving closer to becoming a reality. In this article, and three subsequent articles, US writer Les Rich discusses cable TV's politics, its dreams, its mechanics, and its financial aspects.

First installed in a few remote and mountainous communities in the 1940's, cable TV has been hailed, especially in recent years, as everything from the next big source of entertainment to, as one authority put it, "the first use of the First Amendment in electronics."

Nevertheless, there is considerable justice in the remark by a public relations executive who has just completed an extensive study of the medium: "Cable television is a lot like the Hollywood idol's widow who, after the funeral, said that she had never been kissed. Asked how this was possible, she said, 'All he ever did was look into my eyes and tell me how good it was going to be'."

Not many months ago Equity Research Associates, along with a lot of other analysts, was predicting that cable TV would "emerge as a major national medium for home entertainment and advertising, and a strong competitor to the broadcast networks during the 1970s." The consulting firm thought that domestic satellites and private microwave networks would make it possible to tie cable systems into programming and advertising pools well before the end of the decade.

Going beyond that, the possibility of two-way communication between cablecaster and consumer has been talked about for years, generally in terms of shopping by TV, or market research, with people showing instant reactions to products or advertisements shown on the screen.

Already there are special two-way television hookups for non-commercial uses. The department of Community Medicine of the Mount Sinai School of Medicine in New York, with technical help from the Teleprompter Corporation and funding from the U.S. Department of Health, Education and Welfare, has developed a bi-directional television system using coaxial cable. The system links a pediatric office at the medical centre to an outreach pediatric clinic in East Harlem, about 1½ miles away.

There are others who see cable TV in terms of its non-commercial potential. For instance, there is Theadora Sklover, the energetic director of Open Channel, Inc., a non-profit organization formed to promote the use of cable TV by ordinary citizens. It was Ms Sklover who called public-access cable TV the first extension of the Bill of Rights to electronics, and she was responsible, more than anyone else, through her intensive lobbying, for the FCC ruling that all cable television companies must provide a public-access channel in their systems.

"But right now things are in a bit of a mess," she is forced to admit. "Public access is here, but it's hard to get many people interested in it. Funding is uncertain. What is needed is a basic structure to finance public-access TV out of fees paid by operators to the communities."

Meanwhile, the useful and sometimes artistic work provided by Open Channel and other organizations has so far been in the minority. The casual viewer sampling the public-access channels of New York is more likely to be treated to a Gay Liberation march, a "witch-in" in Central Park, an amateurish satire, with tiresome nudity, by Anton Perich, or a California production described as "a candid video view of Mayor Joseph Alioto of San Francisco as he picks lint off his suit."

But the dream most eagerly awaited, of all the promises of cable TV, is, of course, the money. Just recently, the Wall Street Journal called the acquisition of a cable franchise "a licence to print money." And, as the Journal reported, in city after city across the country, consortiums of powerful people are struggling to gain franchises, which are awarded by the city councils.

In Houston, to take a good example, the winning group was headed by Lester Kamin, a friend of the mayor, and it also included such powers as investment bankers, newspaper people, and members

Above: real time video-taping where and when events occur, and airing them in their entirity on New York's public access TV channels, is a significant function of Open Channel. The photograph at left shows Open Channel video-taping of the New York State Commission on Cultural Resources hearing. At far right is Open Channel Executive Director Theodora Sklover.

The photograph at the top of the page illustrates the extent to which CATV can become involved in community cultural activites. At bottom, left, is the Interactive Data Exchange Module (IDEM), the heart of Teleprompter's new CATV system. Its primary functions are: to receive and process program commands, receive premium TV requests from as many as 32 subscriber terminals in its domain, control the unscrambling circuits within these terminals, and act as a neighbourhood "box office" by collecting and recording data for billing purposes. Data read-out of home charges are periodically collected (bottom, right) and fed into a central computer for billing.

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of John Connally's law firm. Among the also-rans was a group associated with Patrick Nugent, LBJ's son-in-law; along with other local groups and two perennial national candidates, Teleprompter and Time, Inc. (which has more recently moved to get out of the cable business).

In Des Moines, the ruling in favour of Athena Cablevision was upset when two councilmen were indiscreet enough to allow themselves to be quoted that they had voted against political enemies. Another group called Hawkeye-Cablevision ultimately got the franchise, although it sold a minority interest to Athena.

The reasons for all the competition is simple. In Houston, for instance, the expectation is that after seven years the franchise will gross $20 million a year — and this in a city where ordinary non-cable reception is rated good. However, the same franchisee will have to pay the city a fee of $600,000 a year and will, more importantly, have to spend at least $50 million to wire its market.

That's where the problem comes in. Cable TV is, to put it mildly, a capital-intensive business. In the cities, it currently costs something approaching $120,000 a mile to install the cable. One estimate of the total spending in the next decade to connect the cable to all the customers is $3.5 billion. Big money will probably eventually be earned, but you have to have big money to invest laying out large sums for years without much return. Not everybody can make the grade.

In New York, one of the few large cities where the cable has made substantial inroads, the territory of Manhattan was divided between Teleprompter, the nation's largest cable operator, and Sterling Manhattan, 70-per cent owned by Time, Inc. Sterling had 55,000 subscribers but was faced with terrific costs in running its cables under the pavement and up through the city's thousands of apartment buildings. The company lost $2.5 million in 1971 and nearly $4 million in 1972.

One problem seemed to be that Sterling, unlike Teleprompter, didn't have a large nationwide system that could absorb the losses from New York (although the local teleprompter division announced that it would turn a small profit on its own). At any rate, Sterling has just been sold to Warner Cable Corp., a subsidiary of Warner Communications, Inc., second largest company in the field. The price was a smallish $20 million.

"If I can't do it, then that spells the end of urban cable," declares Alfred R. Stern, chairman and president of Warner Cable.

Immodest as it sounds, he just could be right. He's one of the pioneers of city cablecasting, and he stresses that Warner has "professional cable people" as opposed to Time-Sterling's "program oriented" cadre.

At the present time there are about 2,900 cable TV systems in the United States, serving 6.5 million homes in some 5,500 communities. This is only some 10pc of all American homes with TV. And most of the systems are in remote areas where reception is a problem, and where cable TV is doing an excellent job of fulfilling its original role: providing a clear signal where one would not otherwise exist.

The major metropolitan areas remain untouched except for New York, San Francisco, Orlando, and San Diego (where growth was speeded up because of poor local reception).

But, according to the Sloan Commission on Cable Communication, by 1980 about 40 to 60 percent of all US homes will be looped into the cable, with an interconnecting network of cable systems providing for a total of 40 channels. The Rand Corporation and others agree that 1980 is the year when we will begin to have a "wired nation".

CATV is being employed as an educational tool in several New York City public schools where Open Channel is training both teachers and students in the productive use of television. This kind of training often results in the development of new programs which are then aired over public access television.

Above, a home viewer may preview a program by pressing a channel control on Teleprompter's special home terminal unit. At left is Mission Cable Tw.'s TV control room.

New techniques in machine intelligence

Research into robots and machine intelligence is being carried out at several centres throughout the world. This article discusses the problems encountered and the results achieved at Edinburgh University, together with their implications.

by PROFESSOR DONALD MICHIE

Assembly tasks on mass production lines are often simple, monotonously repetitive and are an obvious application for automation. Despite their simplicity however, they have so far defied automation in the sense of completely taking the place of human operators.

Although the actions of sorting component parts from jumbled heaps, preparing them for assembly into a product, and the actual assembly of the product, may well be within the capabilities of even a child, they do involve a combination of complex actions.

From the simulation viewpoint, they involve sophisticated aptitudes of vision and touch-sensing coupled with interpretation and co-ordination. In addition, to be like a human operator, an automated assembly device must have an ability to learn quickly and carry out new tasks. In other words, it must be programmable.

These requirements necessitate software quite different from that used in other computer applications.

The Machine Intelligence Department of Edinburgh University has been engaged in the development of such software for the past five years. Twelve months ago, the stage was reached where it became possible to construct a simple machine capable of being taught to a limited degree how to recognise and manipulate parts and fit them together into a complete assembly.

The equipment is called "Freddy", standing for "Family Robot for Entertainment, Discussion and Education, Retrieval of Information and Collation of Knowledge." It comprises a motor-driven parts manipulator and a moveable platform on which the product is assembled. "Eyes" are provided by two television cameras, one overhead for close-up inspection of individual objects, and one at a 45 degree skew to provide an overall view of the platform. The whole unit is controlled by a Honeywell 316 minicomputer which in turn is interfaced with the department's time-shared ICL 4130 machine.

Freddy operates in two stages, instruction and execution.

In the instruction stage, individual parts are tossed on the platform and Freddy is told, for each possible view of the object, the objects' designation, how to pick it up, and what to do with it; for example, "turn it over" or "put it exactly here in preparation for assembly."

To ensure the system can recognise the part, about five training views are needed for each designation. For instance, in the case of assembling a toy car, "car body on side", "car body on back" etc. Of course it only needs to be told once what to do with the part.

Starting with parts laid out in the fixed position, the robot, working by touch, is guided through the assembly operation by instructions entered on the keyboard of an electric typewriter. The instructions developed at this time to guide the robot, constitute the assembly program. Thenceforth running the assembly program transforms the laid-out parts into the final product.

In the execution stage, someone dumps a pile of parts (perhaps with missing or extra parts) on to the platform and starts the inspection and layout process. Freddy examines the pile and lays out any recognised parts for assembly. This is achieved by a set of routines which can deal with arbitrary heaps of arbitary parts. Extra parts are dumped in a special location. If some of the parts are missing, the robot appeals for help. When all the required parts are laid out, Freddy assembles the product according to his assembly program.

Freddy's performance is based on an elaborate suite of programs which confer a fair degree of flexibility on the system — it can be taught a new assembly, say a model ship, at a day's notice.

How far we still have to go in incorporating "teachability" into software can be judged from the fact that a three-year-old-child can be taught a new assembly in less than 10 minutes!

The discovery of better design principles for "teachable" programming systems is a major goal of most research laboratories in machine intelligence. It is a huge task.

To give an idea of the scale on which the engineering of a single software assignment can be conducted, the writing of one particular program, IBM's OS360 operating system, consumed 3,000 man-years at an estimated cost approaching 30m.

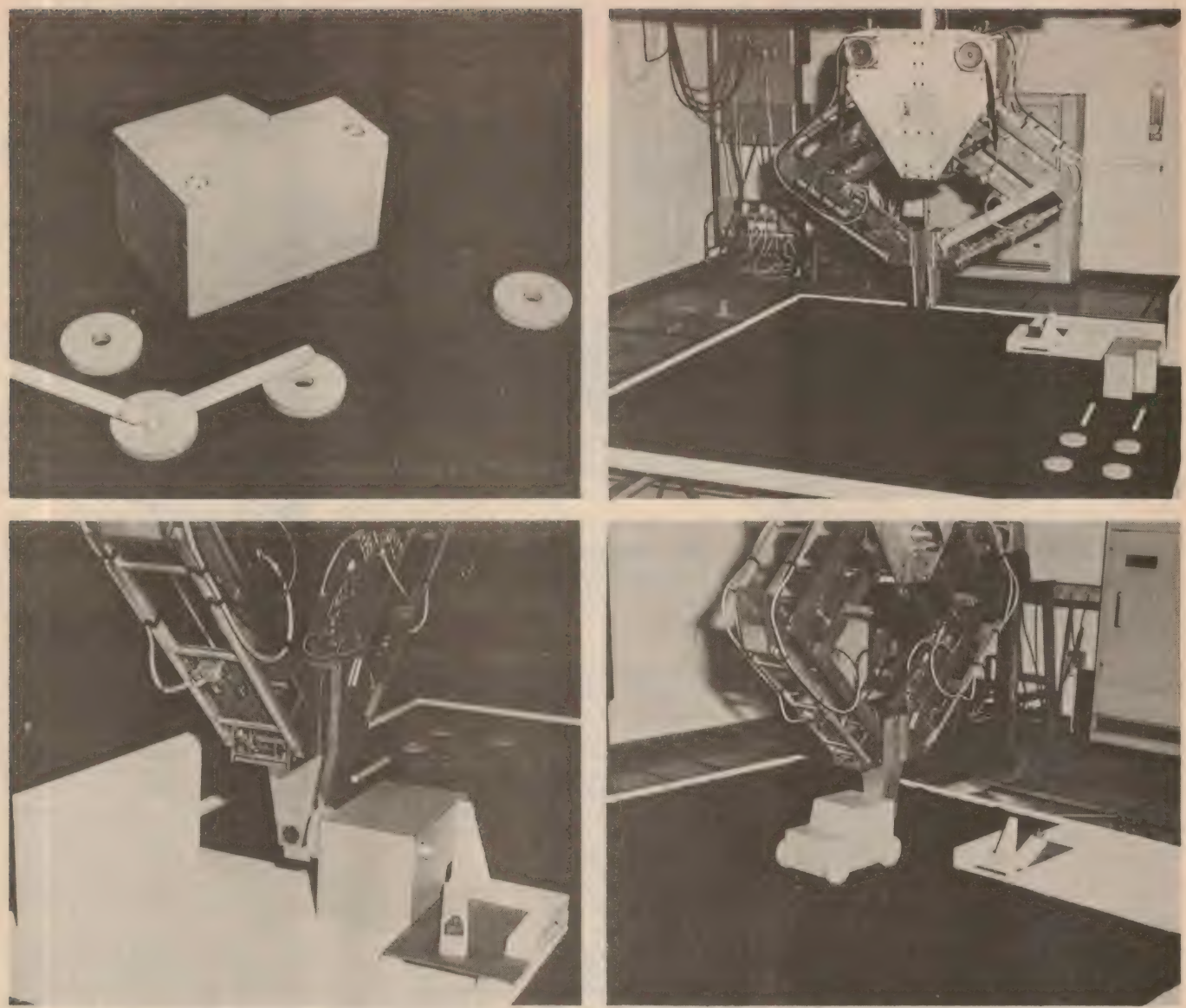
We find, then, that here is a new form of manufacture, the operations of which consist in making marks on paper, with a cost so great that one looks for analogies to such enterprises as the pyramid building of the ancient Egyptians.

There is a difference, however. One brick of the Great Pyramid can be out of place, yet the pyramid will still stand. But one binary digit wrong in a complex computer program can cause the whole to malfunction. Such an error did indeed cause the costly failure of one of the unmanned missions of NASA's space program.

In software there is a premium on accuracy which is quite unprecedented.

Techniques of machine intelligence can come to the rescue via an unconventional interpretation of the principle of redundancy. Classical redundancy operates by replication of similar elements. Thus, a signal is regarded as verified, if and only if inputs from three elements all agree, and each of these has an independent error rate of 1 per cent, then the error of the transmitted signal is automatically reduced to one in a million. But in a machine intelligence program, as in flexible assembly instanced above, the fundamental design principle is "if at first you don't succeed, try something else!" For a given task — say picking a component out of a heap — selection is made from a battery of dissimilar strategies — "grab a protuberent part," "seek isolated object and identify", "stir heap and start again", and so on.

The program is quick to abandon any given strategy if unrewarded by success and to go back to its strategy-pool. The resulting reliability is impressive; sooner or later the program is bound to win through to the given objective. This kind of reliability based on an opportunistic flitting between alternative strategies in the light of what turns up, has not in the past been associated with the behaviour of automatic systems. It is more characteristic of the way that a human tackles a skilled task —



Four stages in the assembly of a toy car by Freddy, the Edinburgh computer controlled robot. An initial random assortment of parts (top left) is first transformed into an orderly lay-out top right. In the bottom left photo an axle, with wheel attached, has just been threaded through the appropriate hole. The last photo shows the final product being propelled in an "acceptance test".

whether driving a car, cooking a meal, or proving a theorem.

Serious research into robot systems is also being carried out in Japan and the United States. In July 1971 the Japanese government announced their "PIPS project."

PIPS stands for "Pattern Information Processing System" and its goals have been characterised in the following terms by an expert American observer Gilbert Devey of the US National Science Foundation:

". . . an inanimate system capable of sensing a pattern (characters, pictures, 3-D objects), identifying the nature of that pattern, relating that information to a data base of information (scene analysis) to then decide on and take a course of action for the control and manipulation of an output device which performs a useful function, and doing so without human intervention."

The United States Government, already investing substantially through its Department of Defence, is responding to the Japanese challenge through additional agencies, notably NASA and the National Science Foundation. Independently of this, activity in robotics is gathering force in numerous American laboratories, for example, the Draper Laboratories in Cambridge, Massachusetts, and IBM's Thomas J. Watson Research Laboratories at Yorktown Heights.

Taking a peep into the future, such machine systems may require rather careful and wise management as time goes on, if only to prevent their human beneficiaries becoming dependent upon them.

The reality of the problem is underlined by the recent announcement of Y. Masuda, director of the Computer Usage Development Institute, that the Japanese Government's 2,500m plan for computerisation includes the development of a prototype "computer-controlled city" in the next 10 years.

The concept here is the total automation of all the support systems of urban life — traffic control, garbage collection, etc.

Such cities belong to the future, and robot vehicles collecting our garbage or tidying up warehouses, or handling airport luggage will not greatly affect our lives, for all their science fiction aspect. What will begin to colour our existence by the end of this decade is the emergence of the "home terminal."

Not only schools, hospitals and commercial firms but also the ordinary householder will be able to tap information and problem-solving power from a national computing grid rather as he now draws on gas, water and electricity. Computer-aided self-instruction will have become a hobby of large sectors of the population by the turn of the century. When home terminals can offer a useful service, the citizen will cease to regard the computer as a monster or a competitior.

Naturally the future holds some negative aspects and dangers which will have to be watched. But the main impression is of a more varied and stimulating world, with the prospects of man being culturally and intellectually master in his own house as never before.

Philips shows VLP player

Advanced models of the Philips VLP home video disc player were demonstrated at this year's International Radio and Television Exhibition in Berlin. The company also gave further technical details about the VLP system, which seems destined for a major role in the home video field.

Readers may remember that we ran a story on the Philips VLP disc system in the November 1972 issue, when it had just been announced. At that time it was only the second video disc system to be announced, taking its place beside the previously-announced Teldec system developed by Telefunken and Decca. Already it was giving signs of being a serious contender for the home video stakes, however, with its potential for more reliable operation and longer playing time.

Since late 1972, of course, the Teldec and Philips systems have been joined by others using a disc as the recording medium. RCA in America and Thomson-CSF in France have both given indications that they have developed video disc systems, one using a capacitive readout and the other an optical transmission approach. But the Philips VLP system is still very much in the running, as shown by their exhibit at this year's Radio and Television Show in Berlin.

As yet only a general indication has been given regarding the likely date at which final production models will be actively marketed, and there has been only a broad indication of the likely price. However, considerably more information has been released concerning the technical aspects of the VLP system. In view of the important position which the system is likely to hold in the home video field, we think readers will find this information of considerable interest.

The VLP system combines a pulse-code recording technique with a 1,500rpm disc speed to obtain the required signal density for video and audio playback. It is thus similar to the approach taken by Teldec, except that the VLP system has no contact between the pickup mechanism and the disc. Instead the readout is optical, using light from a low-power helium-neon laser.

The VLP record, like a conventional audio LP, is 30cm in diameter and is manufactured by a similar pressing operation. It consists of a transparent polyvinyl material which is coated on one side with a very thin reflecting metal layer. The transparent material protects the information track from contamination, so that handling of the record is easy.

The information needed for image composition and sound reproduction is stored in pulse encoded form along a spiral-shaped track, which is read from the centre outward. The track contains one complete image per revolution.

The way in which the information is stored along the track is completely different from that in normal gramophone records. The track on the VLP record consists of a sequence of microscopic oblong pits. All the pits are equal in depth and width (0.16um and 0.8um respectively), and their variation in length and distance from one another contains all the pulse coded information such as brightness, colour, synchronisation and sound. The pitch of the track is extremely small, amounting to 2.0um (centre to centre distance of two adjacent tracks). One millimetre of the record thus contains no less than 500 spiral track windings.

As shown in the example illustrated, luminance information is coded by varying the distance between the corresponding points in successive pits and the chrominance information is carried by varying the length of the pits. During playback, the pit pattern is converted into a train of pulses constituting the carrier. Luminance information will frequency modulate the carrier and chrominance information will be conveyed by pulse duration modulation.

The playback speed of 1,500rpm or 25 revolutions per second was chosen to comply with the European standard transmission rate of 25 pictures per second (a disc speed of 30 revolutions per second is used for the North American market, which has a standard transmission rate of 30 pictures per second). This method facilitates the use of various special operational modes which will be discussed later.

The VLP record can be produced simply and in quantity by normal pressing techniques and, as such, should have a price close to that of conventional audio discs. The low price of the pressed discs should make the system a major competitor for the video tape cartridge, as pre-recorded magnetic video tapes are much more expensive to produce, at least by present day standards.The video tape systems, however, have the advantages of allowing the user to record colour TV programs directly off the air and to make their own home movies with a video camera. The discs are pre-recorded for playback only.

Manufacture of the VLP record closely resembles that of gramophone records. A compound similar to normal grampohone record material is pressed between moulds. After pressing, the records are coated with a thin, reflecting layer of aluminium. The master plate used for the production of the press dies is of a special glass, and is cut with the aid of a high power laser.

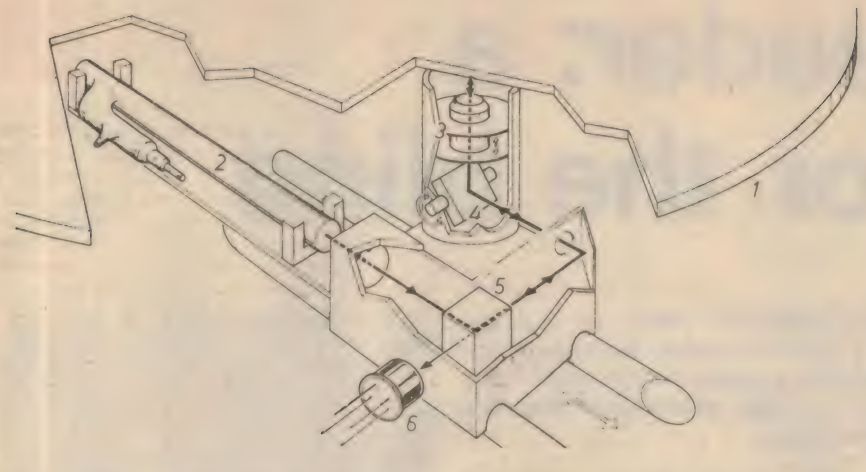
The VLP playback system uses a laser light beam to scan the information encoded on the spiral tracks on the disc. The light spot is projected onto the track via system of lenses and mirrors, and will be reflected according to the track pattern. If the light spot strikes the metal coated surface of the record between the pits, practically all the light is reflected back into the lens of the detector system. If, however, the light spot intercepts a pit, diffraction occurs and, as a result, most of the reflected light bypasses the lens. The pulses produced by the detector diode are then fed to the decoding and signal processing circuits which produce a video signal that can be coupled directly to the aerial terminals of an ordinary TV set.

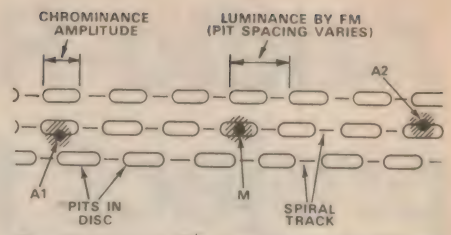
For maximum modulation of the detector current by the pattern of pits on the record, the incident light that is reflected from the bottom of a pit must have a 180 degree phase difference from the light that is reflected from the record surface around the pit, and the intensity of both must be the same. The 180 degree phase difference is obtained by making the depths of the pits equal to a quarter of the wavelength of the laser light source. This results in a pit depth of 0.16um.

In order to obtain a high signal-to-noise ratio in the detector signal, the reflected light beam should have as high an intensity as possible. For this reason, a 1mW helium-neon laser, which can be mass-produced by means of a specially developed production method, has been used. This laser has a high brightness and has low noise at MHz frequencies

Opto-electronic processing of the information track permits the use of certain operational modes that are not possible with traditional mechanical scanning procedures, for example, unrestricted stills, visibie reverse, and immediate random access. The VLP player can be used in the following operational modes: normal picture reproduction, fast forward (reproduction at twice the normal speed), slow motion forward and reverse, and frame by frame reproduction.

These different modes of operation are made possible by the fact that the record





Drawing above illustrates how pits convey chrominance and luminance information and shows the position of auxiliary beams A1 and A2 in relation to the main beam M. At left is a schematic diagram of the VLP unit. The major components are: 1 — record; 2 — He-Ne laser; 3 — objective (for focussing the light beam); 4 — pivoting mirror assembly (for centering the light beam); 5 — prism; and 6 — detector.

speed (25rps) is synchronised with the picture frequency (25 frames per second). Consequently, for each rotation of the track, the field synchronising pulses always fall within two fixed diametrically opposite sections of the record disc, ie, the synchronising pulses are fixed at an angle of 180 degrees to each other. This means that the scanning light spot can be transferred from one track to the next (or the one before if slow motion is required) within the small segments occupied by the synchronisation signals, without this being visible on the TV picture.

Slow motion pictures are produced simply by playing each track on the disc twice, whilst a fast forward picture may be obtained by omitting every second track. A still picture is obtained by continually repeating the same track, and a picture in reverse motion is produced by jumping back a turn at each half revolution.

The VLP player is equipped with automatic control mechanisms for centring the scanning spot on the record track, focusing the optical system, tracking, and keeping the speed of the record constant.

As the scanning beam may deviate only plus or minus 0.2um from the centre of the track (a requirement which cannot be satisfied with even the most accurate purely mechanical scanning systems), an opto-electronic tracking control system was developed. The method employed uses two auxiliary beams of light, each of which is imaged on its own detector by the optical system after reflection from the surface of the disc.

During playback, the main scanning beam is kept centred on the track by a pivoted mirror assembly fitted in the light path immediately behind the objective. This mirror is rotated by a coil, whose effect is to move the light beam in a radial direction. The position of the mirror is controlled by the correction signal derived from the two auxiliary light beams which are obtained by splitting the laser light into three approximately equally intense beams by means of a diffraction grating.

The two auxiliary beams strike the track at a distance of 15um in front of and behind the read-out beam. Both of the auxiliary beams are slightly displaced from the centre line of the track, in opposite directions, so that each is partly on and partly alongside the pit track. The average current through the detectors of the two auxiliary beams is a function of the deviation of the beams from the centre of the track. The difference between the two detector signals is applied to a low pass filter with a cut-off frequency of 20kHz and the resulting output signal forms a correction signal which is applied to the coil of the pivoted mirror.

The electronic circuitry of this control system has been designed in such a way that the ballistic properties of the rotating mirror can be utilised for the special operational modes described above. This requires rapid movement of the beam from one track to another at the appropriate moment, ie during the field synchronising pulses. The beam "jump" is effected by applying an accelerating current pulse through the mirror coil, followed by an equally large retarding pulse.

A pressed record is never perfectly flat, and axial displacements of the order of 500um may be encountered on individual records. It is therefore necessary to employ a further control system to keep the microscope objective focussed correctly on the record surface. The largest displacement component occurs at the fundamental frequency of 25Hz, which corresponds to the speed of rotation of the disc.

It would appear that Philips have developed two different control mechanisms for focussing the light spot on the surface of the record. The first of these methods derives its error signal from a capacitive sensor. The microscope objective used for reading the video signal is suspended by springs and driven by a coil in a radial magnetic field, in much the same way as a moving-coil loudspeaker. The distance between the objective and the record surface is determined by the capacitance between the metallised surface of the record and an electrode bonded to the objective. A circuit consisting of an oscillator and an FM ratio detector performs the capacitance measurements.

The second method derives its error signal from an opto-electronic system similar to that used for centring the light beam on the track. As before, the objective is suspended by springs and driven by a coil in a radial magnetic field. The shift is controlled by an error signal derived from the position of an auxiliary light beam. If the beam is focussed correctly, the reflected beam will induce equal signals in two photodetectors and the resulting output signal will be nil.

During normal playback of the VLP record, the optical system (including the laser) has to be radially shifted at a rate of 2.0um for each revolution of the disc, corresponding to a radial speed of 50.0um/sec. The whole optical system is therefore mounted on a carriage, which is moved along two guide rails by an electric motor and a gear drive. The control signal for the electronic circuitry of the radial transport system is derived from the beam centring circuit described above.

Philips hope to produce the system for the mass market within two to three years at a likely cost of about $400 to $500.

Operation of the Philips VLP system is quite straightforward, even for young children.

Audio-Reader: a project for the blind

Modern technology is not always employed purely for profit, nor is it unconcerned with human problems. In many cases, advanced technology has been used to aid those who are physically or mentally handicapped. This article describes the "Audio-Reader" project, a project where technology has been used to aid those who are visually handicapped.

by BILLY G. BRANT* and THOMAS DOYLE**

Since October 11, 1971, radio station KANU-FM in Lawrence, Kansas, has been operating its "Audio-Reader" service, designed to help those who are visually handicapped keep up to date with the world around them. Consisting entirely of spoken word broadcasts, Audio-Reader provides the visually handicapped with an opportunity to obtain news and information from newspapers, magazines and books.

The Audio-Reader project was conceived in January, 1971, when an anonymous person suggested the idea to Dick Wright, station manager of radio KANU, and promised to provide financial backing for such a project. It was estimated that at the end of Audio-Reader's first year of operation the anonymous donor had contributed more than $100,000.

Audio-Reader broadcasts on a sub-carrier frequency (SCA) radiated by radio station KANU, the non-commercial 20kW FM station at the University of Kansas. The system employs a sub-carrier frequency of 67kHz imposed on the main carrier of 91.5MHz.

A routine day of Audio-Reader broadcasting begins at 8am with readings from local newspapers. The major part of the day, from 10am till 6pm, is made up of prerecorded tapes from books, with hourly changes of material. Interludes of varied programming, such as live readings from current magazines, are also included in this period. Then from 6pm until sign off at 8pm, the format is selected readings from local and regional newspapers.

Transmission facilities consist of a Collins Radio 831-G-1 20kW FM transmitter together with an RCA BFC-12B antenna system mounted on a 600 foot tower. This combination gives the station an ERP of 110kW. The transmitter is remote controlled from studios about one mile away.

Equalised telephone loops are employed to transmit the signal from Audio-Reader's studios to the main KANU studios some four blocks away. At the station's main studios, the audio is "processed" and then sent to the transmitter over another equalised loop.

A good broadband antenna system is required for a successful SCA operation. The system employed at station KANU is an RCA circularly polarised antenna, the output of which is essentially flat over a bandwidth of 200kHz. Crosstalk is minimised by the use of this antenna, and also through the use of peak limiters on all the audio channels which feed the transmitter.

The Audio-Reader plant has two recording / live studios for program preparation and a control room from which program sources are controlled. Equipment in the control room consists of a master control console, two Ampex tape machines, a turntable, and a tape cartridge for short announcements. Monitoring facilities give the console operator the option of monitoring either the line feeding the transmitter or the off-air signal.

Each of the two recording studios contains an Ampex AG-600 tape recorder and a microphone. All programs for the Audio-Reader program are recorded on half track at 3¾ ips. Directional microphones are employed to inhibit any mechanical noise from the tape machines.

Since Audio-Reader is a sub-carrier service, special receivers are required to monitor it. These receivers, which are pretuned to the station's operating frequency, are loaned to the user free of charge by the University of Kansas. There are two reasons for using fixed, pretuned receivers: it prevents the receivers from being used for purposes other than Audio-Reader reception, and it makes the receiver very simple to operate.

The primary coverage area of Audio-Reader is within a 100 mile radius of Lawrence, although some people are receiving the service as far away as 150 miles. Approximately 600 receivers are in use at the present time.

Audio-Reader functions because of the time that volunteers donate to do the reading and the recording. With this type of service, the visually handicapped can take part in the community and in world affairs. It is hoped that Audio-Reader will serve as an example and a motivating factor in the development of other such services.

*Executive Producer at Kanu-FM in Lawrence, Kansas.
**Chief Engineer at KANU-FM.

Audio-Reader's main control room. It is from this console that the material is broadcast. (Photo: Thirk Holland).

Volunteers reading the morning newspapers live from one of Audio-Reader's studios. (Photo: Thirk Holland).

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HALF-PRICE SPECIAL HI-FI RECORDING TAPE

Fantastic purchase of "MYLAR" professional recording tape (the best money can buy). Famous 3-name brand (one we can't mention due to huge price reduction). Silicone lubrication. Suits all tape recorders, hi-fi and stereo. Selling well under half price. ABSOLUTELY BRAND NEW.

3" x 225' 65c — 4oz; 5" x 600' $1.75 — 6oz; 5" LP x 900' $2.45 — 8oz; 5¾" LP x 1200' $2.75 — 10oz.; 7" x 1200' $2.25 — 10oz; 7" LP x 1800' $3.95 — 10oz.

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5" Empty Spools 35c;

CAR STEREO SPEAKERS $12.50 PAIR

Top quality 5", 5 watt, for rear shelf or door. 12ft. of lead each. Super special price! 500 to clear. 3lb.

PARCEL POST RATES

	Up to Old.	2lb. 45c	3lb. 50c	7lb. 55c	11lb. 65c	16lb. 75c	22lb. 85c
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PACKET POST FOR ARTICLES 1lb AND UNDER :- For Aust., N.Z., T.P.N.G. 24oz., 12c, 5-8 oz., 18c. 9-16oz. 24c.

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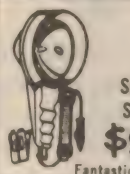
4 amp. 3V-18V, full wave bridge, brand new. 1/2 amp. 35c. 2 1/2" amp. $1. 8oz



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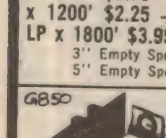
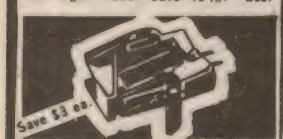
Inlet ¼in Outlet ½in BSP. 3 1/2in. long x 3in. overall.



GOLDRING STEREO CARTRIDGES $15.95

GOLDRING 'G800' FREE FIELD STEREO CARTRIDGE

Type: Magnetic-Stereo and Mono. Frequency response: 20Hz-20KHz. Sensitivity: 1mV per cm./sec. Separation: 25 dB at 1 KHz and nowhere less than 15 dB. Load: 100k-47k ohms. Compliance static: 20 x 10-6 cm./dyne. Effective point mass: 1mg. Stylus point: 0.0005" diamond. Tracking weight: 1-3 grms. Head weight: 8 grms. Connections: 4 pins. Fixing: Standard ½" centres. Vertical tracking angle: 15° Mu Metal Shield for hum protection. Removable stylus. One of the finest transcription type cartridges made! Save 40%. 2oz.



Save $3 ea.

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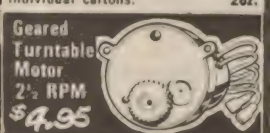

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2oz.

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CM21

CRYSTAL MICROPHONES $1.75

CM21 for desk or hand, high sensitivity load resistance 500K-1M ohms. with 5' lead and plug.

INDUCTION MICROPHONES $1.45

Will pick up sound waves from a distance. Has suction cap, long cord and plug for tape recorder, etc. Sticks to wall or case of telephone for recording speech. 4oz

FOUNTAIN LIGHT $2.95

Another Direct Disposals "first" in "Australia". Battery operated "fibre optics" table display light. This attractive and colourful display lamp will be the focal and talking point of your dining room. Red, green and yellow droplets of light make this a striking display feature and table decoration for Restaurants, Cafes, Night Clubs and your home.

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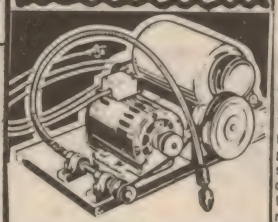
Canadian Manufacture. Brand new in mfrs. carton. Limited Stock 3LB



GEM TUMBLER OUTFIT $34.50

As illustrated above (except for flat wood base) or purchase separately in components as under.

TUMBLER ONLY $12.75

2 mounting blocks, 4 pillow block bearings, shafts, pulleys and belts and 1/2 gal. barrel.

TUMBLER & MOTOR $29.50

Tumbler as detailed above, plus 240V AC motor, fitted with double drive pulley.

TUMBLER, MOTOR & GRINDER $34.50

The complete unit as illustrated. Incorporates extra pillow blocks, shaft, flex. coupling, flex. drive with chuck and 5 grinding stones. All units sold in kit form and takes minutes to assemble, instructions supplied, 3 months' guarantee.

BRAND NEW VOLTMETERS & AMPMETERS 12oz.

Beautifully made. Moving coil, extremely accurate. Brand new 1972 models in cartons. Save $4 each.

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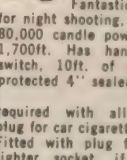

240 V EXTRACTOR FANS $4.75

12 MONTHS GUARANTEE

Brand new English 240 volt A.C. mains operated fans. Make ideal extractor fans for kitchens, caravans and other domestic and light industrial purposes. Continuously rated, smooth, silent-running induction motor, 4,000 r.p.m., balanced 3-bladed, 6½" fan. Size 6½" dia. x 4" deep. 3lb.

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This high-precision Clinometer, made to stringent govt. specifications in gun metal, is graduated with a 20° scale and movement. From dead centre, a fine reading can be taken to the nearest ¼ minute by the micrometer thimble. $5.50

COMPUTER BOARDS

Set of 3 comprising 2 boards 7" x 5" with 1 board 5" x 4" comprising minimum of 25 transistors plus hosts of diodes, resistors, capacitators, inductors, etc. $2.95 set of 3. 12oz.

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3oz

Well made hi-speed brush motor, reversible rotation for blowing or extracting air, cont. duty, has 3" dia. 3-bladed plastic fan. Rush an unrepeatable bargain.

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Post free if with another article.

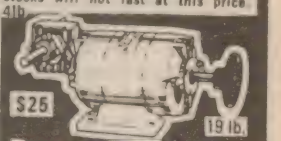
3 months full Guarantee on all goods

Money cheerfully REFUNDED if not completely satisfied.

240v. Electric Pumps BRAND NEW $14.50

Direct English purchase from a famous manufacturer. We purchased their entire stock of these ABSOLUTELY BRAND NEW

240 volt electric motorised pump unit. Usually sell for $25.00. Full 3 MONTH GUARANTEE. Special Neophrene impellor pump for pumping fuel, water, etc. Pumps 300-400 g.p.h. To be gravity fed and will lift to 8'. Ideal for fuel or water transfer, fountains, fish ponds, etc. Pump entirely non-corrosive. Rush your order now as stocks will not last at this price. 4lb



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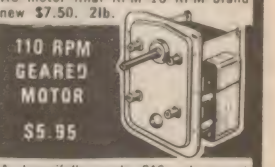
beautifully made originally for computers. Two speed with two 1/2" shafts. Fully ball bearing CAPACITATOR START. 1400 RPM & thru gearbox 100 RPM cont. duty 40 in. lbs. torque. size 12"x5" complete with capacitator

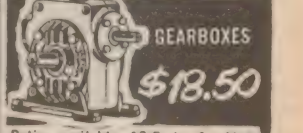
As above 30 RPM, brand new at $35 IDEAL B-B-Q SPITS.

"Carter" geared motors 240 volt AC motor final RPM 16 RPM brand new $7.50. 2lb.



110 RPM GEARED MOTOR $5.95

A beautifully made 240 volt geared motor with tremendous torque. Molibdenum steel gears with approx. 20:1 reduction, continuous duty. 4 threaded hole mounting, can operate in any position. BRAND NEW! cost $14 to make. Rush this bargain. 500 only. 2lb



GEARBOXES $18.50

Ratio available 10.5 to 1. Made by David Brown, "Radicon" England. Very robust construction, has two driving shafts at right angles and oil filler plug. Unit is drilled for 4-bolt fixing, size 4 1/2" x 4 1/2" x 3 1/2". 7/16" and 5/8" dia. x 1 1/4" long shafts (cost over $100 to make). Bargain 100 only. Also 'Radicon' gearboxes same as above 14.5 to 1 reduction $19.50. 9lb

Quadraphonics and the

Sales of high fidelity equipment in Australia are booming and the demand is particularly strong for highly priced quadraphonic systems. While there has been some industry trepidation about the possible price level of colour television receivers, the public is certainly not showing any hesitation about "spending up big" in the hifi market.

Undoubtedly, the boom is due in part to the general economic outlook and to the philosophy that seems to be abroad: If you want it, buy it now!

But other important factors are operating. Much of the uncertainty that earlier characterised quadraphonic sound is being resolved. Dealers can talk to customers in more positive terms — and evoke more positive reactions.

It is now apparent that both the matrix system and the discrete system will survive and co-exist, with the matrix system forming a vital bridge back to conventional 2-channel stereo. The threat of abrupt obsolescence is thus relieved, either for the immediate or the more distant future.

The customer now knows that, if he invests in a matrix quadraphonic system, he can play all his existing 2-channel records on it and, in many cases, gain added listening pleasure in so doing. He is not faced with the need to re-stock his record library.

As for the technically more advanced CD-4 "discrete" system, this can be the subject of a further deliberate decision: whether or not to invest in equipment which provides the added facility. It is the kind of "optional extra" or "bigger and better" choice that is familiar in many product areas.

Up until fairly recently, the CD-4 system had remained largely an enigma: a technically complex approach that might get across, or might go under! But the formidable problems are rapidly being cut down to size, and each new step strengthens the position of those who have been saying that CD-4 will emerge as the most desirable answer to the problems of 4-channel on disc.

In England, for example, a British record changer manufacturer, Glenburn claims to have evolved a record changer which will cope with CD-4, and which uses a ceramic cartridge. And Quadracast Systems Inc is reportedly well advanced with an integrated circuit demodulator, said to be the largest yet linear IC.

Obviously, many customers have decided against a quadraphonic system at this stage, because they consider it musically unnecessary, or too expensive or too awkward from the furnishing viewpoint. For this reason, sales of conventional 2-channel stereo equipment have come on strong, and exhibitors have returned from the recent bevy of hifi shows with bulging order books.

But, equally, there is no doubt that quadraphonic systems have "arrived" as far as the public is concerned. The low end of the market is being catered for by loudspeaker matrix adaptors, selling for ten or eleven dollars, plus forty or fifty dollars for an extra pair of loudspeakers.

Above that, budget-priced complete systems take over at about $300, with more pretentious systems, covering both the matrix and the CD-4 approach, ranging upwards from about $800.

In last month's issue, we made special mention of the new "Technics" quadraphonic systems, one marketing at about $800 and the other at about $1000. Our evaluation of the new models obviously anticipated the market reaction.

Geoff Dawes, sales promotion manager of Haco Distributing Agencies, told the writer that all supplies until January next have been pre-ordered by dealers throughout Australia, and are being sold as soon as they hit showrooms.

Doug Brown, electronics buyer for Grace Bros in Sydney, confirmed the public reaction to quadraphonic systems, and buyer inclination to spend up rather than down. Functionally, both the Technics models featured last month are adequate for quality domestic requirements but says Doug Brown, "the $1000 model is outselling its $800 counterpart by about 4:1".

It's the car options outlook all over again, and it's good news for the hifi industry.

An optimistic note is also apparent from the Sharp camp. Bill Lawless, Victorian Sales Manager for the Sharp Corporation of Australia says that this country provides his company's strongest market anywhere in the world on a per capita basis.

Quote: "The buying rate per head of population for our equipment, ranging from $200 to $800, is a good 40pc better than the per capita figures for America, which has long been recognised as the world's top market."

The Sharp Corporation is also concentrating heavily on quadraphonic systems and, says Bill Lawless: "In Australia we have gone way over our sales targets — so much so that we have been in short supply for some time.

"Imports have been drastically increased to meet the demand . . . we do not expect the demand to fall off for years yet . . ."

Sales leader for Sharp is the quadraphonic record player / multiband radio combination type GS-5830A. With belt-driven turntable, and comprehensive level controls on all loudspeakers the GS-5830A has been designed to integrate with a wide

Two new turntables, announced recently by Plessey Garrard are the 86SB (left) and the Zero 100SB (right). A development from the very successful earlier models, the new turntables incorporate belt drive and will therefore meet the demand of those who prefer it to the more usual stepped-idler mechanism. A 4-pole screened synchronous motor is used, fitted with a 2-step pulley; a long-life systhetic rubber drive belt links this to a hub which is an integral part of the machined, die-cast turntable. Both turntables provide for tab-controlled automatic play but, whereas the 86SB has a conventional arm with offset headshell, the Zero 100 SB has the now well known articulated arm which virtually eliminates tracking error. (From Interson Pty Ltd, 64 Winbourne Rd, Brookvale, 2100).

HiFi Scene

range of other hifi equipments in the Sharp range.

These include the new RT-442X stereo cassette player, which features an in-built Dolby system, fast forward and reverse wind, an automatic program finder, separate VU meters for each channel, and wide frequency response. Recommended retail price is $149.00.

For the reel-tape enthusiast, Sharp can offer a number of equipments, but the RT727-H is typical. Using the normal 4-track configuration on 7-inch reels, the RT727-H can record and play at either of 2 speeds, in mono or 2-track stereo. Other features include automatic shut-off, sound-with-sound for simultaneous recording with playback, and a selector switch to optimise the characteristics for particular tapes. Recommended retail price is $189.

From the other side of the continent, Leroya Industries have announced the release of Memorex tape cassettes and open reel tapes exhibiting a further improvement in performance characterteristics. The announcement reflects the pressure by tape manufacturers to escalate the performance of basic oxide formulations and thus avoid the necessity, as with CRO2 tape, to change bias and erase levels in recording equipment.

According to Memorex literature, the new MRX2 formulation used in their latest cassettes gives them an advantage over other quality tapes of at least 3.5dB signal / noise ratio, 3.5dB in high frequency response, lower distortion and lower compression.

Cassettes using the new formulation carry prominent reference on the overwrap to MRX2 oxide.

Carrying over the improved technology to open reel and cartridge tapes, Memorex claim that their new 5in and 7in reels also show a general lift in performance, with longer playing time An equivalent upward movement is apparent in Memorex cartridges, which now come in 45, 60 and 90-minute configurations. (Details from Leroya Industries Pty Ltd, 266 Hay St, Subiaco WA 6008.

Latest product from the Sony stable is this four channel reel-to-reel tape recorder model TC-854-4S. With four channels and four signal heads, it can be used to record and play fully discrete quadraphonic sound on standard quarter-inch tape. Alternatively, the facilities can be used for two-track stereo with over-dubbing. The TC-845-4S will accept 265mm reels, and the 3-motor twin capstan drive will operate at three speeds from 38 to 9.5cm / sec. Control is by "feather touch" buttons and electrical performance is of a high standard. Sony is represented in Australia by Jacoby Kempthorne Pty Ltd, 469 Kent St, Sydney 2000.

A new name on the local hifi scene is "Coral".

Its first association is with a most impressive range of Japanese made loudspeakers and loudspeaker systems being imported by General Accessories, of 443 Concord Rd, Rhodes, NSW. The initial release to "Electronics Australia" indicated something like sixteen complete systems and more than twenty loudspeaker units and sundry ancillaries.

Included in the range are a number of systems boldly designated by type numbers. Most of them are of the multiple speaker, bass reflex configuration.

At one end of this series is the BX601, a

H. Rowe: new PEAK products

Four new products have been added recently to the line of PEAK hifi equipment marketed in Australia by H. Rowe & Co Pty Ltd, of 185 Hoddle St, Richmond, Vic 3121. Illustrated at left is the 12in woofer, model L305, designed to cover the range from 30Hz to a maximum of 5000Hz. Intended to work with it is the HM-16 (top left) a 5in dome type mid-range unit to cover from 1kHz to 10Khz. The remaining loudspeaker is the 3¾in dome tweeter HT-49, covering the range from 2kHz to 18kHz.

Illustrated above is the new PEAK KA-400 amplifier, with a rated power output of 20W RMS per channel and a frequency response of 20Hz to 20kHz. It features push-button front panel controls, a slider type balance control and provision for two loudspeaker systems. It is housed in an attractive walnut finished cabinet.

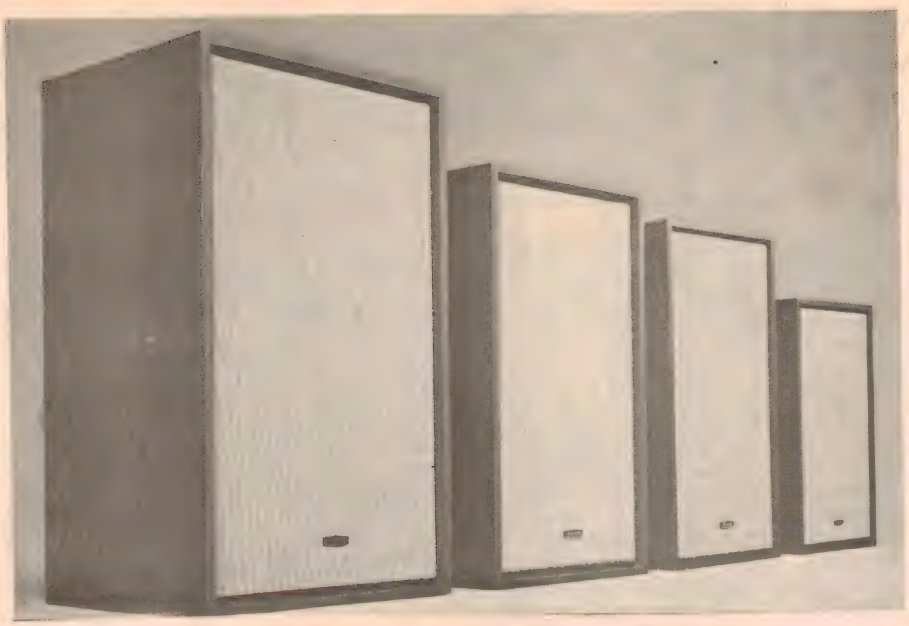
compact unit measuring only 16in high and using a nominal 6in woofer and a small cone tweeter. At the other end of the range is the BX-1500, a free standing floor model with 15in woofer and six other speakers for the mid and upper range including two horn-type tweeters.

The ratings on these systems would need to be digested and interpreted to ensure making the wisest choice. They are rated to handle a certain maximum "Music power" which would probably be twice the nominal RMS rating. Thus the small BX-601, rated at 25W, would almost certainly be regarded in Australia as a 12W RMS unit, consistent with its 6in woofer.

Similarly, the 150W BX-1500 could probably be expected to cope with up to 75W RMS, which is still a lot of power!

The "Flat-S" Series pictured above is additional to the foregoing and is a series which General Accessories are keen to bring to the notice of audiophiles.

Whereas the other systems use multiple drivers, the Flat-S Series is built around a single wide-range loudspeaker in each case. The smallest system in the series has a 5in all-frequency driver and is rated at 15W (unspecified but probably equivalent to about 8W RMS). In round figures, it measures 17 x 10 x 8 inches.



The "Flat-s" series from Coral, marketed in Australia by General Accessories. They feature a single wide-range high-sensitivity driver in a bass reflex enclosure. The type numbers 10S, 8S, 6S and 5S give the clue as to the size of the drivers.

The Flat 6S is rated at 20W, the Flat 8S at 30W and the Flat 10S at 50W (unspecified but probably all "music power"). In round figures, the Flat 10-S measures 26 x 15 x 13 inches. All cabinets are of the bass reflex type and are finished in walnut.

But if you are one of the many audiophiles who prefer the sealed enclosure, multiple-speaker approach, Coral are [illegible]al again to the occasion, with their "Stage" series.

The Stage-1 system uses a 6in woofer and 2in tweeter in an 18in high cabinet, to meet power requirements up to 30W (music). Stage-3 is a 3-speaker system with 8in woofer, housed in a 22in high enclosure, and with a power rating of 50W music.

Stage 5 has four speakers, a 10in woofer, a 24in high enclosure and a music power rating of 60W. In the Stage -7, the figures are four speakers, 27in high and 80W.

An interesting feature of the Stage series is that a dispersion lens is fitted in front of the mid-range and tweeter loudspeakers to prevent beaming of the sound. The lens is shaped like a set of fan blades but is, of course, fixed.

As might be expected, the long throw high compliance woofers in the fully sealed enclosures impose a penalty in terms of sensitivity and the Stage series would be most suitable for situations where driving power is not at a premium. If sensitivity is a paramount consideration, the figures suggest that the Flat-S series would have a marked advantage, or one of the systems mentioned at the outset.

In a market currently dominated by American and Japanese instruments, the release of an English-made electronic organ is certainly news. The new organ is a product of the Kentucky Organ Company, admittedly an unlikely name for an operation centred in Poole, Dorset, UK. It is actually one of the Brock group of companies, which are well known in the UK for radar and other marine equipment. The Kentucky "Adventurer" pictured above is the first of a number of models to be released within the next few months. Priced at $2695, it would appear to be highly competitive with other instruments on the market. In addition to a representative set of voices on the manuals, it has a selection of percussive voices, and generous functional controls, including presets. A two-speed "rotatone" loudspeaker is fitted as standard, while the "power" department provides three separate channels, each rated at 30W RMS. Details and specifications are available from F. Payton & Son, 1st Floor, 218 Clarence St, Sydney 2000.

Here's a superb stereo sound source you'll still be proud to own ten years from now.

And it will still be up to date. Of course, you do need to be discriminating, and realise where long term value lies in terms of precision engineering and its relationship to performance. *We suggest you invest wisely in:—*

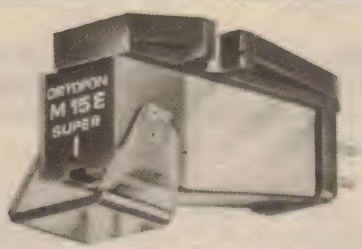
THE NEW SWISS MADE THORENS MODEL TD 160 TRANSCRIPTION TURNTABLE.

Incorporating the radical new Thorens TP 16 tone arm — *the arm overseas reviewers have enthused over* — the Thorens TD 160 offers unrivalled engineering at a most attractive price. A 16-pole two-phase synchronous motor and belt drive combined with a dual chassis suspension system provide a wow and flutter figure of 0.06% according to DIN 45507, weighted. *This is a remarkable figure in anybody's language.*

The platter of the TD 160 is of non-magnetic zinc alloy, 12" in diameter and weighing 7 lbs. Two speeds are standard — 33⅓ and 45 rpm. Stray magnetic flux has been minimised so that even the most sensitive cartridges may be used with the TD 160 without incurring problems with hum induction.

Bearing friction of the revolutionary Thorens TP 16 tone arm has been reduced to less than 20 milligrams in both planes measured at the stylus tip.

Your Bleakley Gray dealer will be pleased to demonstrate the all-new Thorens TD 160 transcription turntable. No doubt he'll also show you the superb **Thorens TD 125 Mk. II** electronic transcription turntable, a three-speed model which is undoubtedly *the most sophisticated turntable manufactured in the world today.* The TD 125 Mk. II has many superior features and naturally costs more than the TD 160. Both Swiss made Thorens turntables offer *long term reliability* and an *extraordinary standard of performance.*



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Here is the article you've been waiting for:

Playback Preamplifier for Cassette Decks

by LEO SIMPSON

Thinking of making a stereo cassette playback deck? You can do so quite easily, by buying a deck transport mechanism for about $30 and adding this easy-to-build high gain stereo preamplifier. It uses two economy operational amplifier ICs, together with four silicon transistors.

For some years now, stereo cassette players have been becoming more plentiful and more ambitious in their specifications. At the same time, their prices have not dropped but tended to rise. In view of this it is not surprising that we have had many requests for articles on a do-it-yourself cassette player. But until recently, cassette transport mechanisms have been almost impossible to obtain.

Fortunately, the situation has now changed for the better as far as the do-it-yourself hobbyist is concerned. Panel Parts Pty Ltd, of 16 Winbourne Road, Brookvale, NSW 2100, are now distributing in Australia the Vortex cassette transport mechanism. Of Japanese manufacture, it has a stereo record-replay head and an erase head and is driven by a 110VAC capacitor-run synchronous motor. It is supplied complete with five push-buttons and a 1uF 250VAC capacitor to run the motor.

It was the availability of this deck which prompted us to develop the preamplifier presented here, but no doubt it can be applied to other decks and/or other tape heads, when and if they become available.

A preamplifier for cassette playback has to meet very stringent requirements, the first being adequate gain. Measurement of the signal available from the playback head of the Vortex deck shows that no more than a few hundred microvolts is delivered, even at high recording levels. This is typical of stereo cassette decks and is a function of the low tape speed of 4.75 cm / sec (1 / ips) and the narrow track width of 0.3 millimetres.

By comparison, the input sensitivity of the high-level inputs of most modern amplifiers is of the order of 100 millivolts. If we assume that the typical minimum signal level available from a cassette playback head is 100 microvolts, then the preamplifier should have a voltage gain of at least 1000. In addition, it must provide compensation for the fall-off in bass response of the head, which means that at the lower frequencies, ie, around 50Hz, the required gain is of the order of 10,000.

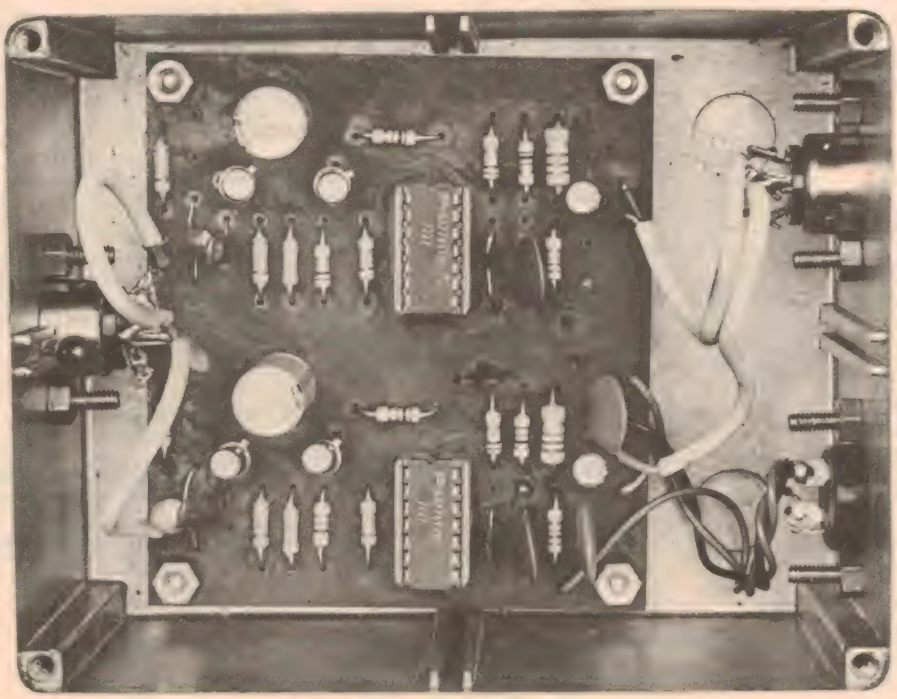
Clearly, the conventional two-transistor direct coupled preamplifier which is adequate for magnetic cartridges has nowhere enough gain for this purpose. In fact, a two transistor pair even with no feedback applied can barely manage a voltage gain of 2000. On top of this, considerable negative feedback must be applied in any reasonable preamplifier to compensate for transistor parameter spreads, provide the necessary frequency compensation and reduce distortion to a low level.

Taking into account the required amount of closed-loop gain (gain of an amplifier with negative feedback applied) and the amount of negative feedback, we find it desirable that the preamplifier should have an open-loop gain (gain without negative feedback applied) of at least 100,000. Four stages of amplification are required to achieve this.

Against the very high gain requirement, the preamplifier must contribute very little noise to the signal, otherwise the signal-to-noise ratio will be unsatisfactory. A typical preamplifier will have an effective input noise voltage of several microvolts ("input noise voltage" is the residual noise output voltage divided by the gain of the preamplifier). When compared with the likely output signal level available from a playback head of a few hundred microvolts it can be seen that the designer will be lucky to achieve a signal-to-noise ratio of better than 40dB.

Input impedance of the preamplifier needs to be about 20k. Lower impedances will reduce the high-frequency output of the playback head, while higher impedances are undesirable from the viewpoint of minimising noise.

In a conventional circuit with this order of input impedance the input coupling capacitor needs to be about 0.5uF or more, if the bass response is to be maintained to below 50Hz. Electrolytic capacitors are



All the gain you need for playback from a cassette deck. Note the sockets for the integrated circuits. Adequate shielding is provided by a diecast case.

definitely taboo here since their leakage current can cause head magnetisation and resultant distortion, as well as contributing to noise.

Ideally, the input capacitor should be eliminated because the charging current for the capacitor at the point of "switch-on" can also cause head magnetisation. The obvious approach then, is to use a FET for the first stage.

Our initial development work proceeded from this assumption. We used a FET as the first of four stages. The FET was direct-coupled to the following NPN transistor, to provide the necessary input impedance without an input coupling capacitor, and a gain of about 50. Further gain and the necessary frequency compensation was provided by the following two stages, which were also direct-coupled.

While this approach certainly provided the necessary gain, we found it not possible to design a circuit around currently available economy FETs which would not require adjustment by the constructor to make it function correctly. Signal-to-noise ratio was also not as high as we would have liked.

Our next approach was to use an operational amplifier, with the idea of using balanced supply lines so that the input coupling capacitor could again be eliminated. The operational amplifier to be used was the Fairchild uA741 or its equivalents (generally with 741 appearing in the type number). These are now available at a very reasonable price of around a dollar or less.

Unfortunately there are two main problems with the 741 op amp when used by itself. It is too noisy for the purpose, and its minimum open loop gain is too low.

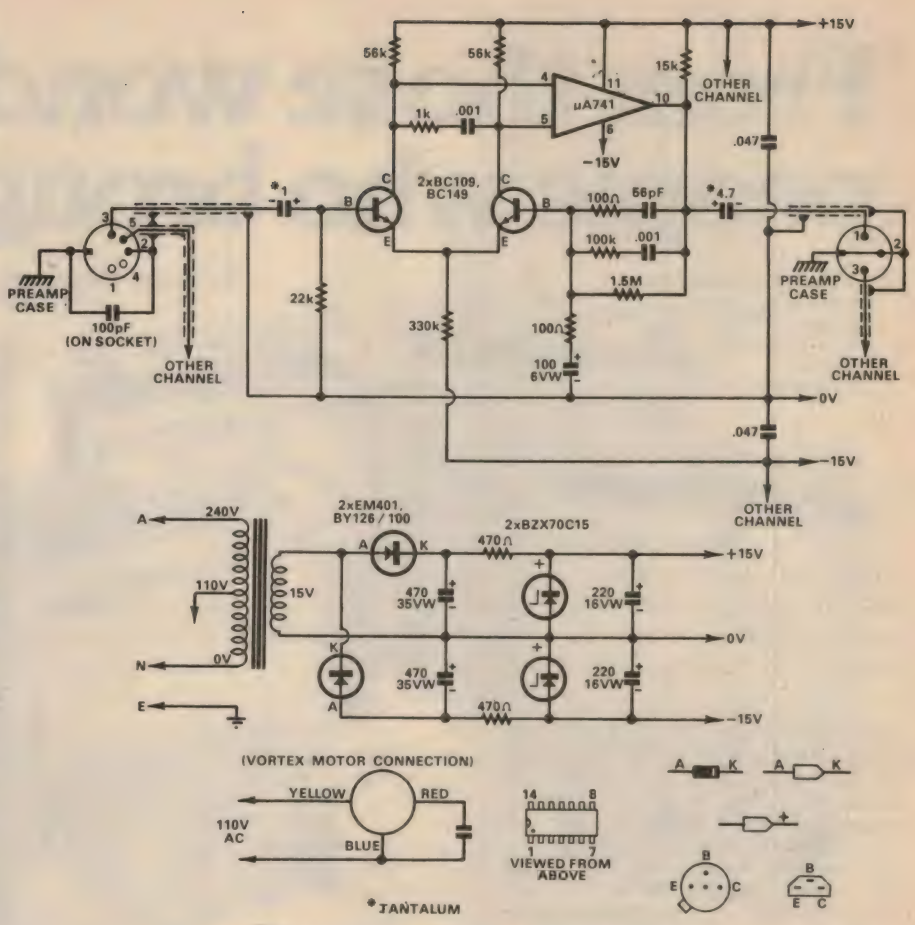
These two problems can be solved rather elegantly by driving the operational amplifier by a differential amplifier consisting of two low-noise silicon NPN transistors. This provides the additional gain required and in so doing ensures that the noise performance of the circuit is determined by the low noise transistors which are better than the op amp. At the same time, it is still possible to couple the input signal in directly, eliminating the capacitor. But more on this later.

Refer now to the circuit diagram. The two transistors in the differential amplifier each run at a collector current of just over 20uA. This figure is a compromise between gain and noise performance.

Frequency compensation is determined by the series network consisting of 100k resistor and .001uF capacitor, and gain at frequencies above about 1kHz is set by the ratio of the 100k resistor and the 100 ohm resistor in series with the 100uF capacitor. The 1.5M resistor sets the maximum bass boost of the preamplifier while at the same time supplying bias current for the associated transistor.

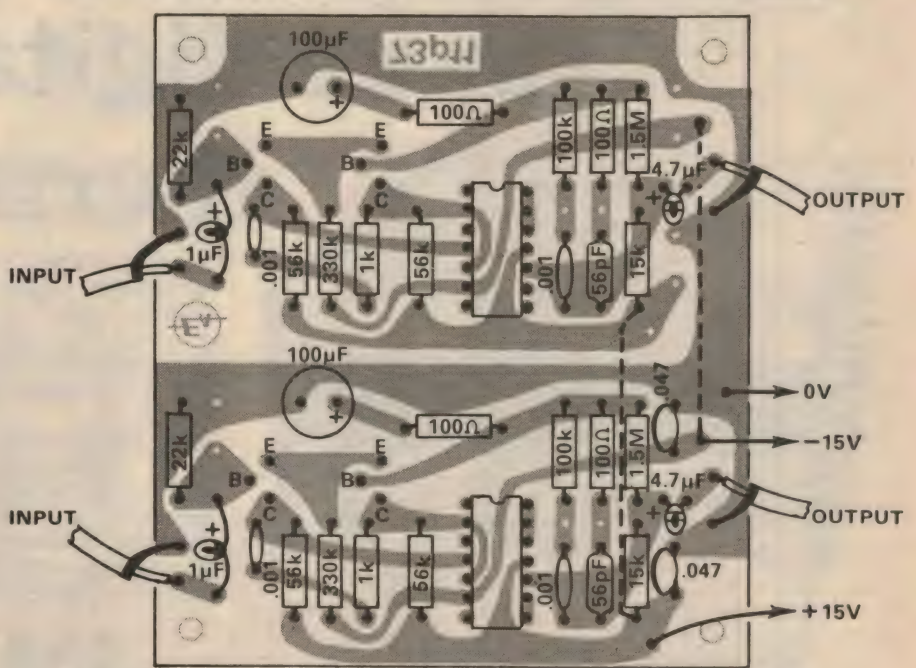
The 100 ohm resistor and 56pF capacitor in series act to roll off the frequency response in the supersonic region so that the circuit response to RF interference is reduced. The 1k resistor and .001uF capacitor in series between the collectors of the input transistors acts to improve stability of the circuit.

An interesting facet of the circuit is the 15k resistor connected between the output of the op amp and the positive supply line. This causes a current of 1mA to flow into the output of the op amp and so acts to reduce



EA CASSETTE PLAYBACK PREAMPLIFIER 1/PRE/28

A well-filtered supply is specified to ensure low hum output from the preamplifier.



This component diagram shows the full size pattern of the printed wiring board.

cross-over distortion, which can occur in the class-B output stage of the op amp. With this order of output current, the output stage of the op amp is operating in class-A at output voltages up to about 2V peak-peak.

The latter two features of the circuit are credited to M.L.G. Oldfield of the University of Oxford. They were suggested in a number of improvements listed by Mr Oldfield in the letters section of "Wireless World" for March 1973, in reference to a circuit by D. R. S. Hedgeland featured in the letters section of the same journal in December 1972. We discovered these circuits, to our chagrin, after spending some time in development of our own basic circuit. However we were able to save some time and effort by adding the circuit

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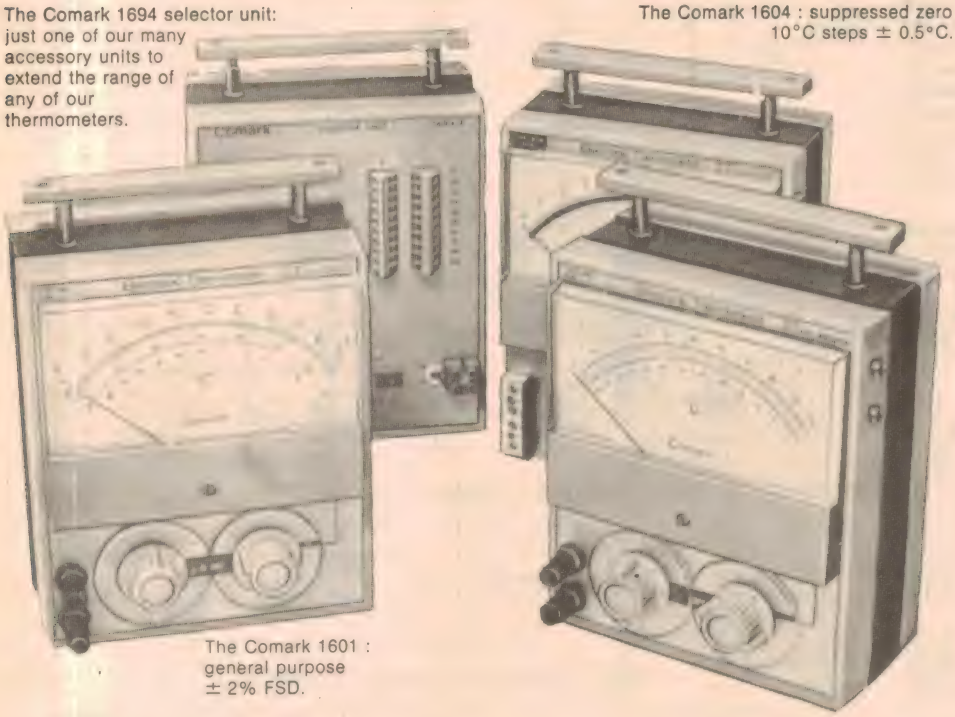

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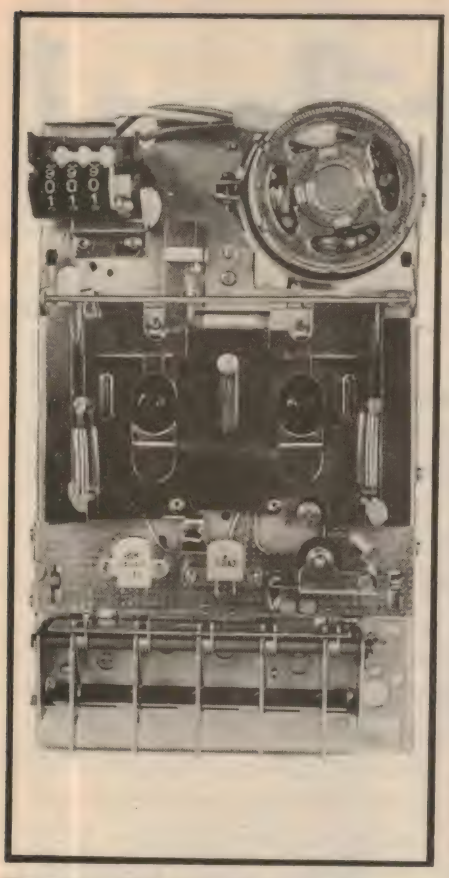

The preamplifier suits the playback head of the Vortex deck shown here.

LIST OF COMPONENT PARTS

1 Transformer with 15V secondary and 110V primary tap at 90mA. A&R 9369, Ferguson PF 3723 or equivalent.
1 STC diecast box measuring 120 x 95 x 55mm.
1 printed board, 73p11, measuring 86 x 76mm.
1 4-pin polarised socket.
1 3-pin DIN socket.
1 5-pin DIN socket.
2 14-pin IC sockets.

SEMICONDUCTORS
2 uA741 operational amplifiers, 14-lead DIP, 8-lead Minidip or 8-lead metal can
4 BC109, BC149, BC209 Silicon NPN low-noise transistors
2 EM401, BY126 / 100 silicon diodes
2 BZX70 / C15 zener diodes (15V, 1.5W)

CAPACITORS
2 x 470uF / 35VW electrolytic
2 x 220uF / 16VW electrolytic
2 x 100uF / 3VW electrolytic (preferably tantalum)
2 x 4.7uF / 6VW electrolytic (preferably tantalum)
2 x 1uF / 6VW metallised polyester or tantalum electrolytic
2 x .047uF / 25VW ceramic
4 x .001uF / 50VW polyester or polystyrene
2 x 100pF / 63VW ceramic or polystyrene
1 x 56pF / 50VW ceramic or polystyrene

RESISTORS
(¼ or ½ W, 5pc tolerance)
2 x 1.5M, 2 x 330k, 2 x 100k, 4 x 56k, 2 x 22k, 2 x 15k, 2 x 1k, 2 x 470 ohms, 2 x 100 ohms

MISCELLANEOUS
Shielded cable, hook-up wire; screws, nuts, solder.
Note: Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases provided ratings are not exceeded.

features just mentioned. As a spin-off, we were also able to adapt the design into an RIAA preamplifier for magnetic cartridges, as shown elsewhere in this issue.

Readers will note that in spite of the earlier statement that the input coupling capacitor should be eliminated, we have still specified a 1uF capacitor. The reason for this is as follows. If the replay head is directly coupled to the preamplifier, most of the base current for the input transistor will flow through the head. Under worst case conditions, this base current could be as much as 0.5 microamp, which would seem appreciable enough to cause head magnetisation. Hence, we have specified the 1uF capacitor. At the same time, since the DC voltage across the capacitor is very low (of the order of 100mV or less), there is no excessive charging current of the capacitor at switch-on, so that its presence does not cause significant head magnetisation.

Supply voltage for the preamplifier is plus and minus 15V. This order of voltage was decided upon because it is just as easy to provide as any other when a power transformer is to be used, and because the operational amplifier performance is better at higher voltages. The supply is derived from a transformer with a 15V secondary via a centre-tapped voltage- doubler rectifier (can also be considered as two half-wave rectifiers in inverse-parallel). Initial filtering is provided by two 470uF / 35VW electrolytic capacitors.

Further filtering and regulation is provided by two 15V zener diodes, fed by 470 ohm resistors. The zener diodes are shunted by 220uF / 16VW capacitors to provide even further filtering. We have specified 1.5W zener diodes because they have a lower dynamic impedance than the cheaper 400mW types. This is desirable to obtain maximum attenuation of the 50Hz hum components from the rectifier and is a better method than merely specifying very large capacitors. All this care with filtering is essential because of the extreme sensitivity of the preamplifier to low frequencies.

All the preamplifier components, minus the power supply are mounted on a printed board measuring approx 86 x 76mm (3⅜ x 3in). Two links are necessary to connect the positive and negative supplies from one side of the board to the other. These links are insulated hook-up wire, installed on the copper side of the board. Two .047uF ceramic bypass capacitors connected between the positive and negative rails to the zero rail filter RF signals which tend to be picked up by the supply lines.

We used 14-pin dual in-line 741s and instead of soldering them directly into circuit we used IC sockets. These prevent damage to the IC which can occur when soldering, and also obviate de-soldering in the event that the IC fails or the user wishes to experiment. The sockets we used are made by McMurdo (Australia) Pty Ltd and are available from most kitset suppliers.

Note that since pins 1,2,7,8,12,13 and 14 have no internal connection in the 14-lead package of the uA741, this means the copper pattern of the printed board is also compatible with the 8-lead "minidip" and 8-lead metal can package versions of the uA 741. This should mean there will be no supply problem with this component. For both 8-lead packages, pins 1 to 4 should connect to

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pins 3 to 6 respectively of the socket and similarly, pins 5 to 8 should connect to pins 9 to 12 of the socket.

The board has been designed specifically to suit ¼W resistors, but ½W resistors may be used. Whatever the rating, low noise types such as cracked carbon or metal film must be used. Printed circuit board electrolytics have been used, but pigtail types may also be used, mounted vertically. The input capacitor may be a metallised polyester or tantalum electrolytic, but not an ordinary aluminium electrolytic.

Note that since the other electrolytics in the preamplifier circuit (100uF and 4.7uF) have very little DC voltage applied to them, they ideally should also be tantalum instead of conventional aluminium types. This is to prevent the possibility of de-polarisation and eventual loss of capacitance (and increase in power factor) which can occur in electros. However, tantalums may be regarded as optional because modern aluminium electros are very much improved in this regard compared to electros of former years.

The preamplifier must be shielded as thoroughly as possible and the easiest way of doing this is to mount the printed board in a diecast box. Mount it so that it clears the base of the box by about 10mm using screws and spacers. We used a diecast box from STC measuring 12 x 9.5 x 5.5mm.

Three sockets are needed to make connections to the board. A four-pin socket for the three supply leads, a five-pin DIN socket for the input shielded cable and a three-pin DIN socket for the output connection. Shielded cable is used to connect the input and output sockets to the board.

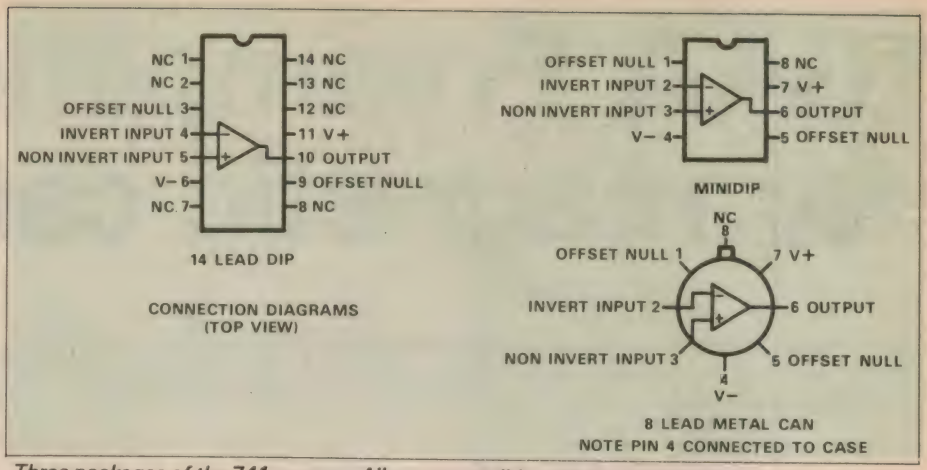
The shield connection of the input socket is bypassed to RF signals by a 100pF ceramic capacitor connected across to earth lug on the socket. This prevents RF picked up by the outer shield of the cable being radiated inside the box and into the circuit. At the output socket, the shield connection is connected to the earth terminal (of the socket) so that the case is earthed.

The power supply can be assembled on Veroboard or a length of tagstrip, but whichever is used should not be installed inside the same case as the preamp, otherwise hum can be induced into the preamp circuit.

Having described the operation and construction of the preamplifier, let us make a few comments on running the Vortex transport mechanism. As mentioned earlier, the motor is a capacitor-run, synchronous type intended for operation at 110V. At least one retailer of these decks advocates connecting the motors to run directly from 240VAC, with the motor windings in series across the mains and the capacitor connected from one side of the mains to the motor centre-tap.

This is a "bodgie" connection at best, with little to recommend it. For a start, the motor windings were not designed for 240VAC operation and the insulation between windings may possibly be over-stressed. Second, it will probably not generate full torque, although torque does seem to be more than adequate in normal operation. Third, the motor draws substantially more power and besides running much hotter will have considerably more external field and mains hash radiation, which both tend to be induced into the playback head and input leads.

We strongly recommend 110V operation



Three packages of the 741 op amp. All are compatible with the printed board.

of the motor. With this in mind, two companies have made available to us, prototype transformers with 110V taps on the primary winding. These will presumably become available to components suppliers shortly after this issue goes on sale. They are the Ferguson Type PF 3723 or the A&R type 9369. Both these transformers have a 15V secondary to provide for the DC supply rails.

Alternatively, if the reader cannot obtain one of these transformers or an equivalent, he can run the motor via a suitable dropping resistor from the mains. For example, a parallel combination of two 3.3k 10W resistors would do the job. Make sure they are adequately ventilated as they will dissipate about 13 or 14 watts between them, and become quite hot.

Make sure that all mains wiring and the transformer are kept as far away as possible from the preamplifier input lead and playback head. A little experimentation with the transformer orientation can reduce the residual hum level of the preamplifier output quite markedly. With some care in the layout of the resultant playback machine, it is possible to obtain a signal-to-noise ratio of better than 40dB with respect to zero VU recording level.

The noise output of the preamplifier is substantially hiss, and its level is comparable with most high performance imported cassette decks at prices of around $300 and more.

Frequency response will depend very much on the recorded tapes available but with good quality tapes, a response within plus or minus 3dB from 30Hz to 7kHz is attainable, with usable response to 10kHz. With a better quality head, performance could be considerably improved.

RIAA Preamplifier for magnetic cartridges

As a "spin-off" from the Cassette Playback Preamplifier presented elsewhere in this issue, we present this high performance RIAA preamplifier for magnetic cartridges. It has high overload margin, very low distortion and low noise.

by LEO SIMPSON

As mentioned above, the preamplifier presented here was developed as a "spin-off" from the Cassette Playback Preamplifier. As such, it does not supersede the Low Noise Preamplifier featured in September 1971 (File No 1/PRE/26), although it does provide slightly better performance in some respects. Both are capable of very high performance; the differences are more or less academic.

Before describing the operation and construction of the preamplifier, let us compare its performance to the design just mentioned. First, the new preamplifier has more gain. At 1kHz, it delivers 110m V for an input of 1mV and as a bonus, its gain can be adjusted higher or lower to suit the application. At a gain of 110, maximum input signal at 1kHz is 80mV and it has a similar order of overload margin over the whole frequency range. If the gain is reduced, the overload margin will be correspondingly improved, although it should be more than adequate as it stands.

With respect to noise, the new preamplifier has more gain and so could be expected to have more noise output. However comparative listening tests between the old and new preamps suggest that the differences are marginal. Measuring the noise with the input loaded by a typical magnetic cartridge and referring it to an input signal of 10mV gives a signal-to-noise ratio of 75dB. The old design is 3dB better in this respect.

Note that we have taken the measurement with the input loaded by a typical magnetic cartridge, instead of with the input open-circuit. The latter test gives more conservative results but is unrealistic — not too many people listen to their amplifiers with no source connected!

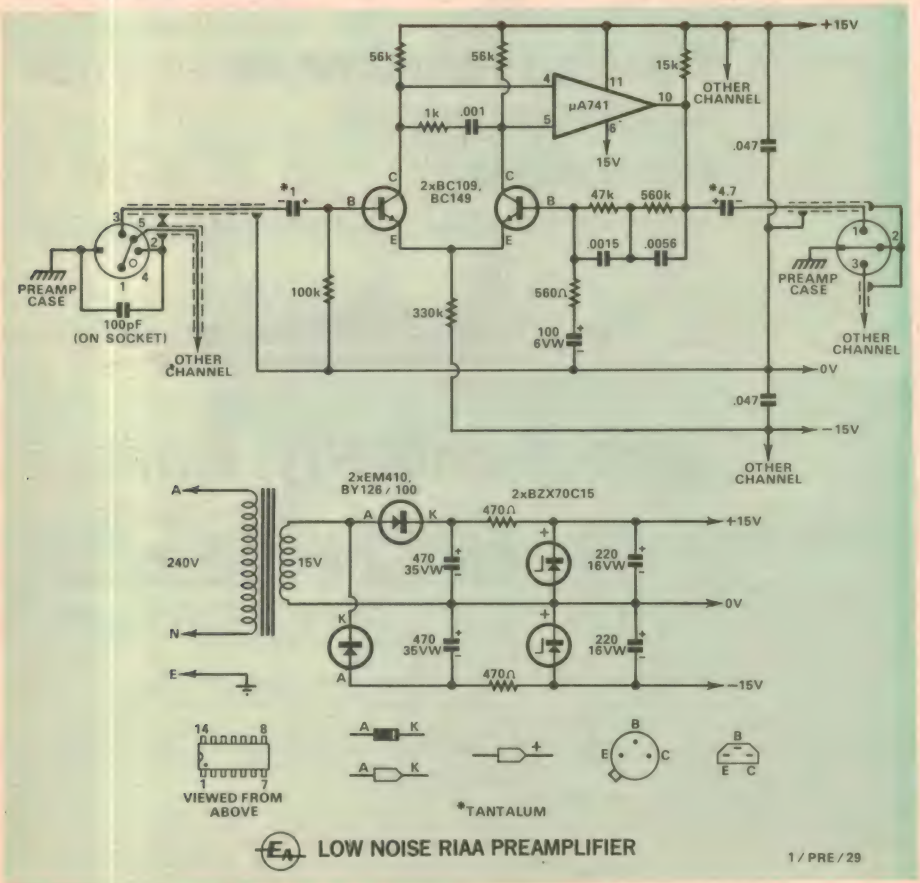
The signal-to-noise figures are unweighted, ie, filters have not been used to exclude frequencies outside the audible spectrum. Weighting would undeniably give a better result. In a practical situation, the noise level of the preamplifier will depend very much on the internal shielding of the cartridge and the incidence of hum fields from transformers and mains wiring on the input leads.

The other major feature of the preamplifier is its low harmonic distortion. We found it difficult to measure the distortion, as it was clearly less than the residual distortion of the measuring equipment. Hence, we rate the preamplifier at less than 0.1pc THD for frequencies from 30Hz to 20kHz and output voltages up to 3V RMS.

Whatever the distortion content contributed by the preamplifier, it is negligible compared to the distortion generated by the magnetic cartridge so that further improvements in this respect seem like "gilding the lily." The important thing is that the preamplifier cannot be overloaded by any currently available cartridge, whereas the preamplifier in many commercial amplifiers does suffer from this fault.

Apart from performance comparisons, the new circuit has three advantages over the previous design featured in September 1971. First, it does not require transistors selected for beta such as BC109C or BC109B. Second, the gain can be adjusted. Third, cartridges with other than the usual impedance characteristic will not suffer a degradation in bass response due to the rather unusual feedback configuration of the earlier circuit.

Referring now to the circuit, readers will note that it is basically similar to the Cassette Playback Preamplifier. The major



SPECIFICATIONS

Frequency response: Within 1dB of RIAA characteristic from 30Hz to 20kHz.
Sensitivity: 2mV for 220mV output at 1kHz and input overload capability of 80mV at same frequency. Nominal input impedance 50k.
Noise: Residual noise output with a typical cartridge connected is less than 0.2mV. When referred to an input voltage of 10mV, the unweighted signal-to-noise ratio 75dB.
Distortion: Less than 0.1pc THD for frequencies from 30Hz to 20kHz at output voltages up to 3V RMS; at voltages up to 9V RMS, less than 0.2pc.

difference is that the feedback components have been changed to suit the signal characteristics of magnetic cartridges.

Basically, the circuit uses a differential amplifier comprising two low-noise silicon NPN transistors driving an operational amplifier integrated circuit. Thus the low-noise transistors determine the noise performance of the circuit rather than the characteristics of the IC.

To ensure lowest possible noise from the differential amplifier transistors, they are run at a low collector current of about 22uA each. The balanced output signals from the collectors of the differential pair are fed to the inputs of the operational amplifier and negative feedback around the circuit is applied to the base of one discrete transistor from the output of the op amp. RIAA characteristics are determined by the 47k and 560k resistors in combination with the .0015uF and .0056uF capacitors, and the ratio of the impedance of this circuit to the 560 ohm resistor determines the overall gain of the preamplifier.

Bass roll-off at frequencies below 30Hz is accomplished by the 10uF capacitor in series with the 560 ohm resistor. The

PARTS LIST

1 diecast box, 120 x 95 x 55mm
1 printed board, 73p11, 86 x 76mm
1 4-pin polarised socket
1 5-pin DIN socket
1 3-pin DIN socket
2 14-lead IC sockets
1 power transformer with 15V winding

SEMICONDUCTORS
4 x BC109, BC149, BC209 silicon NPN low-noise transistors
2 x uA741 operational amplifier, 14 lead DIP, 8-lead Minidip or 8-lead metal can
2 x EM401, BY126 / 100 silicon diodes
2 x BZX70 / C15 zener diodes (15V, 1.5W)

RESISTORS
(¼W or ½W, 5pc tolerance)
2 x 560k, 2 x 330k, 2 x 100k, 4 x 56k, 2 x 47k, 2 x 15k, 2 x 1k, 2 x 560 ohms, 2 x 470 ohms.

CAPACITORS
2 x 470uF / 35VW electrolytic
2 x 220uF / 16VW electrolytic
2 x 100uF / 3VW electrolytic (preferably tantalum)
2 x 4.7uF / 6VW electrolytic (preferably tantalum)
2 x 1uF / 25VW polyester or tantalum electrolytic
2 x .047uF / 25VW ceramic
2 x .0056uF / 100VW polyester or polystyrene
2 x .0015uF / 100VW polyester or polystyrene
2 x .001uF / 100VW polyester or polystyrene
1 x 100pF / 63VW ceramic

MISCELLANEOUS
Shielded cable, hook-up wire, screws, nuts, Veroboard for power supply, solder.

Note: Components with higher ratings may generally be used, provided they are physically compatible. Components with lower ratings may also be used in some cases, provided ratings are not exceeded.

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capacitor also ensures 100pc DC feedback so that the DC voltage at the output is as close as possible to that of the input transistor's base, ie, approximately zero. This means that the maximum output voltage swing is available without any adjustment being necessary.

Gain of the preamplifier may be varied by adjusting the 560 ohm resistor. To increase the gain, reduce the value of the resistor and vice versa. For example, to obtain a gain of approximately 75 times, the resistor should be increased to 820 ohms. We do point out, however, that we have not made tests on the preamplifier at gain levels differing greatly from that of the specified circuit. A general caution would be not to vary the preamplifier components unless the constructor knows what he is about!

At high frequencies, input impedance of the circuit is around 50k, in spite of the fact that the bias resistor feeding the first transistor is 100k. At lower frequencies, the input impedance does increase slightly but this is not important.

A series network consisting of a 1k resistor and .001uF capacitor ensures stability of the preamplifier at high frequencies. At the same time, the 15k resistor connected from the output of the op amp to the positive 15V rail averts another nasty problem, that of cross-over distortion. It may seem something of a paradox that cross-over distortion could occur in a preamplifier circuit but the fact is that the uA741 op amp has a class-B ouput stage. Hence the 15k resistor to provide a current of 1 milliamp into the output, and provide class-A operation for output signals up to about 2V peak-peak. For larger signals, any cross-over distortion is likely to be negligible.

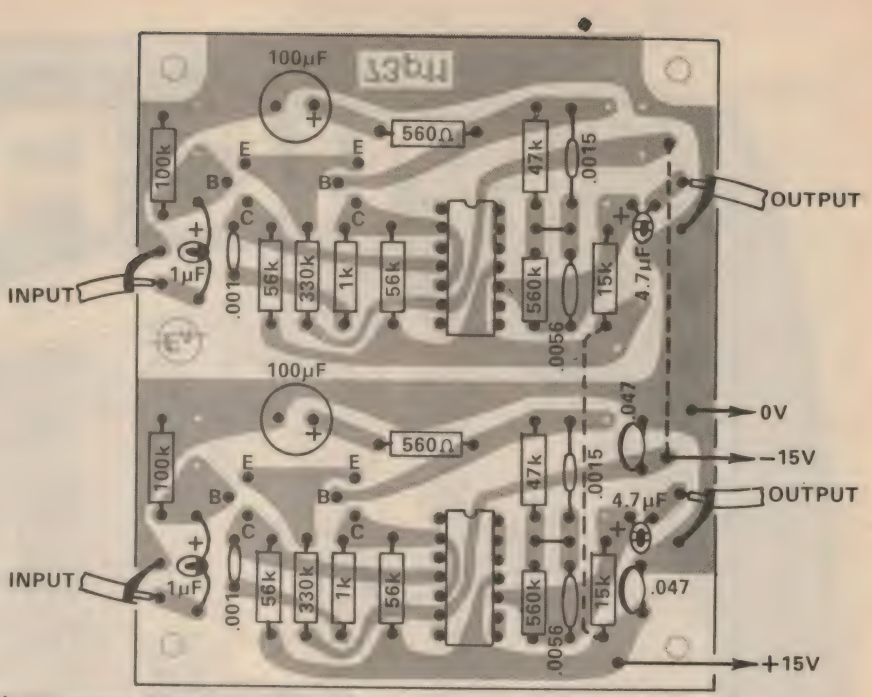
Input coupling capacitors should be 1uF tantalum types or, if size is not a problem, metallised polyester could be used. Since the two other signal capacitors in the circuit, 10uF and 4.7uF, have very little DC voltage applied to them, they ideally should be tantalum types also, although modern aluminium electrolytic capacitors are very much less prone to depolarisation and attendant loss of capacitance than earlier types.

Supply rails are plus and minus 15V which enables the maximum output voltage of the preamplifier to be just over 9V RMS. It is this which gives the high input signal overload capability, despite the high gain.

A pair of .047uF ceramic capacitors are connected between the positive and negative rails to the common rail, to bypass any RF signals and "hash" that might be picked up by the supply cables. They also prevent any instability of the preamplifier which might occur due to the inductance of long supply leads.

The balanced 15V supply lines are derived from the mains via a transformer with a secondary winding of 15VAC. This should have a current capability of 50mA or more. Alternatively, if the amplifier with which the preamplifier is to be used has balanced supply lines, it may be possible to derive the necessary voltages from the amplifier. Current consumption of the preamplifier is light, at about 5mA for the two channels.

Two half-wave rectifiers are connected to the 15V transformer winding to provide plus and minus 21 volts, approximately. Filtering is provided by two 470uF / 35VW electrolytic capacitors. We do not recommend 25VW capacitors for this application. The 35VW units provide slightly better filtering and have greater voltage rating margin.



This component diagram shows the full size pattern of the printed wiring board.

Regulation and further filtering is provided by two zener diodes fed by 470 ohm resistors. The zener diodes are 1.5W units, which provide better filtering and spike suppression than the smaller 400mW types. At a pinch, though, the 400mW units could be used without any circuit modification. Further filtering is provided by 220uF / 16VW capacitors shunting each zener diode. These capacitors also remove any noise produced by the zener diodes themselves.

The rather complex supply is necessary to ensure that no residual hum or noise superimposed on the mains supply, such as "spikes" or switching tones, does not appear in the preamplifier output.

As noted above, the noise performance of the preamplifier depends substantially on the shielding of the cartridge and the incidence of hum fields on the input leads. For

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INTERDYN

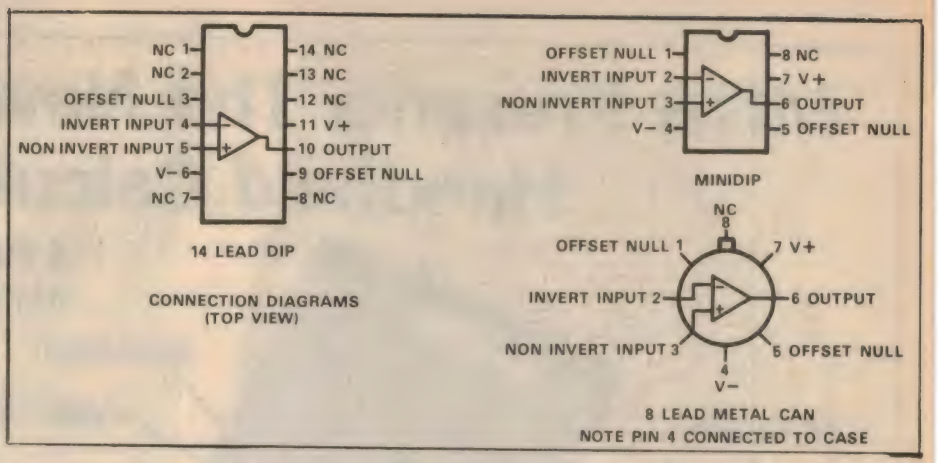
this to be true, the preamplifier itself must be well shielded otherwise it will contribute hum also. The best and easiest way to accomplish this is to mount the preamplifier in a standard diecast box. The one we used measures 120 x 95 x 55mm.

A printed board, coded 73p11 and measuring 86 x 76mm, accommodates the preamplifier components. It is the same board as featured for the Cassette Playback Preamplifier. The board is an easy fit in the diecast box just mentioned.

Hole spacing on the board suits ¼W or ½W resistors, with ¼W types giving the neatest result. Low noise resistors should be used, such as carbon film or metal film. Ordinary carbon composition resistors should only be used if the constructor does not care about noise — in which case he should not build the unit in the first place. While the board has been designed to suit printed circuit mounting capacitors, pigtail types may be used if they are mounted vertically.

We recommend the use of sockets for the integrated circuits. They eliminate the possibility of damage to the IC while soldering, and obviate the necessity to de-solder if the IC fails. The sockets we used were made by McMurdo (Australia) Pty Ltd and are available at reasonable prices from most kitset suppliers.

Since pins 1, 2, 7, 8, 12, 13 and 14 are unused in the 14-lead package of the uA741, the copper pattern on the board is also compatible with the 8-lead Minidip package or the 8-lead metal can package. With the 8-lead Minidip package for example, the IC may be pushed straight into the socket with pin 1 of the IC connecting into pin 3 of the socket. Similarly, the leads of the 8-lead metal can type may be bent to suit the socket. This means that hopefully there should be no supply problems with the uA741.



Three packages of the 741 op amp IC. All are compatible with the printed board.

Discrete transistors may be the BC109 (metal TO-18) or BC149 (lockfit) or the Fairchild BC209 plastic type.

Two links of insulated copper wire are soldered on the copper side of the board to connect the supply rails from one side of the board to the other. See the wiring diagram. Note that there is only one pair of .047uF ceramic bypass capacitors on the board. These capacitors should preferably not be polystyrene or polyester types as these can have appreciable inductance, as far as radio frequencies are concerned. Ceramic capacitors are better as RF bypass capacitors.

A 5-pin DIN socket is used for input connection and a 3-pin DIN socket for the output connection. A 4-pin polarised socket is used to connect the three supply leads. The shield connection of the input socket (pin 2) is bypassed with a 100pF ceramic capacitor to the "earthy" terminal on the same socket. At the output socket, the "earthy" connection is connected to pin 2 (the shield connection), so that the case is connected to the common line. Note that at no point in the circuit is there a connection back to the mains earth. This connection is made automatically when the preamplifier is connected to an amplifier.

Mount the board so that it is spaced away from the bottom of case by a clearance of about 10mm with the aid of screws and nuts and spacers.

Note that input cables to the preamplifier from the cartridge should be kept as short as possible. This is to keep hum induction at a minimum, and also to keep cable capacitance to a minimum so that high frequency attenuation is minimised.

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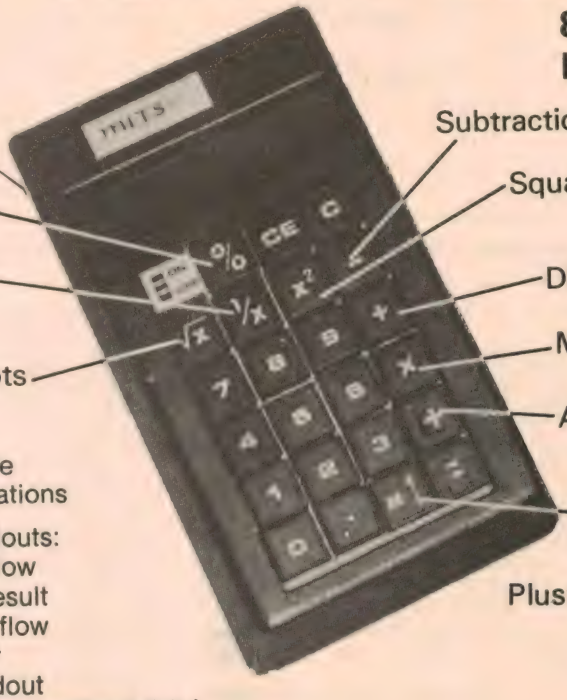

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Press C	Press C	Press C	Press C
Enter 2.375	Enter 6	Press −	Enter 19
Press −	Press %	Enter 4	Press +
Enter .068	Enter 220	Press −	Enter 17
Press =	Press =	Press −	Press √x
		Enter 3	Press ÷
		Press =	Enter 2
			Press x^2
			Press −
			Enter 5
			Press 1/X

CALCULATIONS USING MEMORY:

−4 x 32 x 16 =	M^3	(−4) + (−3) =	M + 6
Press C	Press C	Press C	Press C
Press −	Press M	Press −	Press M
Enter 4	Press X	Enter 4	Press +
Press X	Press M	Press +	Enter 6
Enter 32	Press X	Enter 3	Press =
Press X	Press M	Press =	
Enter 16	Press =		
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Morse code keyboard uses ICs, novel encoding system

Most designs for automatic Morse sending keyboards have been rather complex and forbidding. This one, originally published in an overseas magazine, took our fancy because of its intriguingly simple encoding system. Radio amateurs keen on minimum-effort CW operation should find it of particular interest.

by ALBERT D. HELFRICK, K2BLA

The growing popularity of low cost digital integrated circuits has inspired their use in many communications circuits. The most basic application is to the international Morse code. Several digital Morse code message generators have appeared in amateur literature, along with a handful of keyers, keyboard senders, and a complicated machine to print the code. Here is an all integrated circuit Morse generator using a surplus keyboard, transistor-transistor logic and a unique encoding scheme.

In order to understand the mechanism of the keyboard sender, the operation of the individual logic building blocks must be understood. The reader is referred to the literature for a discussion of NAND gates, binary counters, flip-flops and shift registers.

In this keyboard sender the Morse character to be sent is described by two "data words." The first word will be called "bit count" and the second will be called "dash position." The bit count word is a binary number representing the sum total of dots and dashes in the Morse character. The dash position word, which is the same length as the Morse Character, indicates dashes by a "1". For example, the letter C (—·—·) has a code 100 1010. The first word is the binary equivalent of 4, or the sum of 2 dots and 2 dashes. The second word indicates that the dashes are sent in the first and third positions. Similarly, the letter G is coded 011 110 and the number 4 is 101 00001.

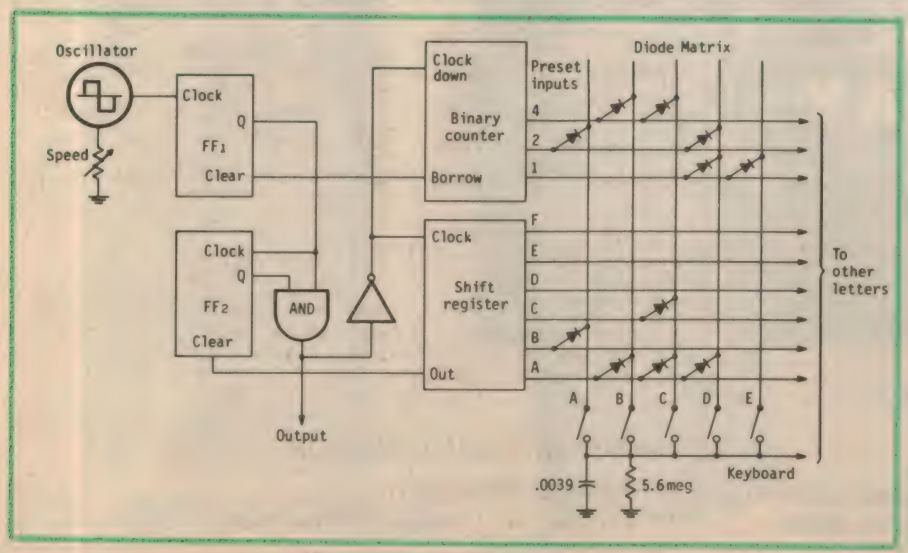
This method of digitally encoding the Morse characters does not represent the shortest data word length possible. This system has a maximum bit count of nine, that is three bits for the first word and a maximum of six bits for the second data word (assuming that the Morse sender is required to send only letters, numbers and punctuation). Another system which has been described elsewhere has a bit count of seven. The two additional bits require no extra logic, and this system was chosen to be compatible with an electronic Morse printer designed and built by the author.

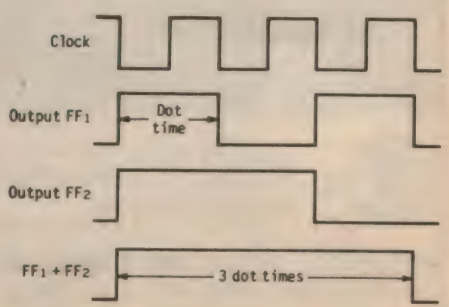
Actual encoding from the keyboard is accomplished by a diode matrix. It was originally planned to use a braided wire encoder to save costs, and a prototype sender was constructed using this technique. The method proved unsatisfactory for the unit described since the surplus keyboard used was unable to switch the heavy current pulses required.

Fig. 1 shows the basic circuit, together with the diode arrangement for the first five letters of the alphabet. Assume the "A" key is closed. This allows current to flow from the binary counter "2" input and the shift register "B" input through the diodes and key switch to charge the capacitor. It only takes a few micro-seconds for the capacitor to charge to a voltage high enough to stop the current flow. However this is sufficient time to store the data into the counter and shift register. Once the key switch is released the capacitor discharges through the 5.6 megohm resistor which provides a certain amount of key interlocking plus contact bounce suppression.

The sequence of character generation is as follows. Any key closure presets the up-

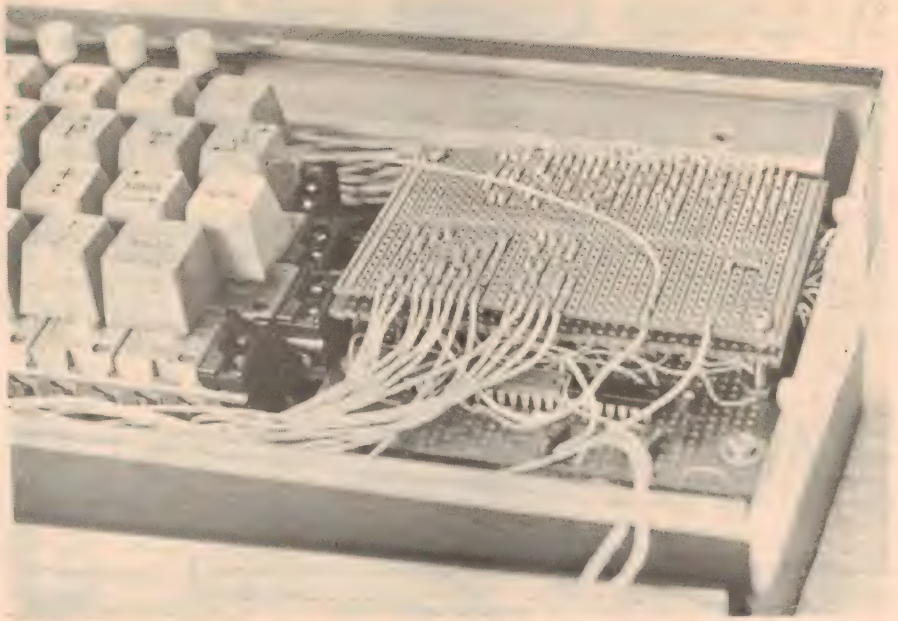
Above is the author's prototype keyboard, housed in a surplus computer terminal. The electronics section is at the right-hand end. Below left is Fig.1, showing the simplified schematic. The .0039uF capacitor and 5.6M resistor are for bounce suppression. Fig.2, below, shows the waveforms for generating a dot and a dash.





down binary counter and the "clear" input of FF1 goes high with the "borrow" output of the counter, allowing the flip-flop to toggle with the first negative transition of the clock. (See Fig. 2). This initiates the character generation. Consider the letter "R" coded 011 010. The first bit in the shift register is a "0" hence the output of the shift register is low, causing FF2 to be held low and inoperable. Therefore the second clock pulse returns FF1 to a low state and sends "dot." The high to low transition of the dot advances both the counter and shift register. (The bi-directional binary counter actually counts down, advancing toward 000.) Now, the output of the shift register is high, allowing FF2 to operate. The next negative transition of the clock again toggles FF1, which in turn toggles FF2, producing the waveforms shown in Fig. 2.

The negative transition of the output advances the counter and the shift register. The shift register output is again low, therefore a dot will be sent. Once more the shift register and counter are advanced; however, the counter has been returned to zero. This causes the Borrow output to go low and disables FF1, completing the character. The machine will remain in this state until the counter is again preset by a keyboard entry.



The electronics section of the keyer mounted inside the author's surplus computer keyboard. The diode matrix is above the board mounting the ICs.

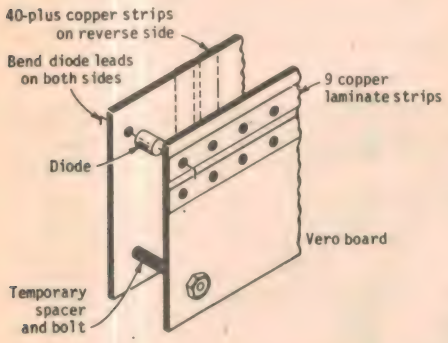


Fig.3: Construction of the diode matrix. Two pieces of Veroboard are used, with their copper strips at right angles. This makes for a very compact arrangement.

Now for the construction. The entire prototype unit is built inside a used computer terminal keyboard. Several of the keys of the keyboard were removed since their functions have no Morse counterpart. This left enough room to assemble the entire electronics package inside.

The integrated circuits are mounted on a piece of Veroboard. This type of circuit board is easy to work with and is an absolute necessity for construction of the diode matrix. The copper strips are broken where necessary by careful hand drilling, using a 3/16" twist drill.

A successful diode matrix starts with careful shopping for low-cost diodes. These should be silicon signal diodes; do not use germanium diodes even though their price looks attractive. The reverse leakage current may cause false triggering.

Careful planning and testing are absolutely necessary, since once the matrix is made it is difficult to repair.

	Counter			Shift register					
	4	2	1	A	B	C	D	E	F
,	X	X		X	X			X	X
.	X	X			X		X		X
?	X	X				X	X		
/	X		X	X			X		
A		X			X				
B	X			X					
C	X			X		X			
D		X	X	X					
E			X						
F	X					X			
G		X	X	X	X				
H	X								
I		X							
J	X				X	X	X		
K		X	X	X		X			
L	X				X				
M		X		X	X				
N		X		X					
O		X	X	X	X	X			
P	X				X	X			
Q	X			X	X		X		
R		X	X		X				
S		X	X						
T			X	X					
U		X	X			X			
V	X						X		
W		X	X		X	X			
X	X			X			X		
Y	X			X		X	X		
Z	X			X	X				
0	X		X	X	X	X	X	X	
1	X		X		X	X	X	X	
2	X		X			X	X	X	
3	X		X				X	X	
4	X		X					X	
5	X		X						
6	X		X	X					
7	X		X	X	X				
8	X		X	X	X	X			
9	X		X	X	X	X	X		

Fig.4: The diode encoding chart for the keyer. The "X"s represent diodes, wired as in Fig.1.

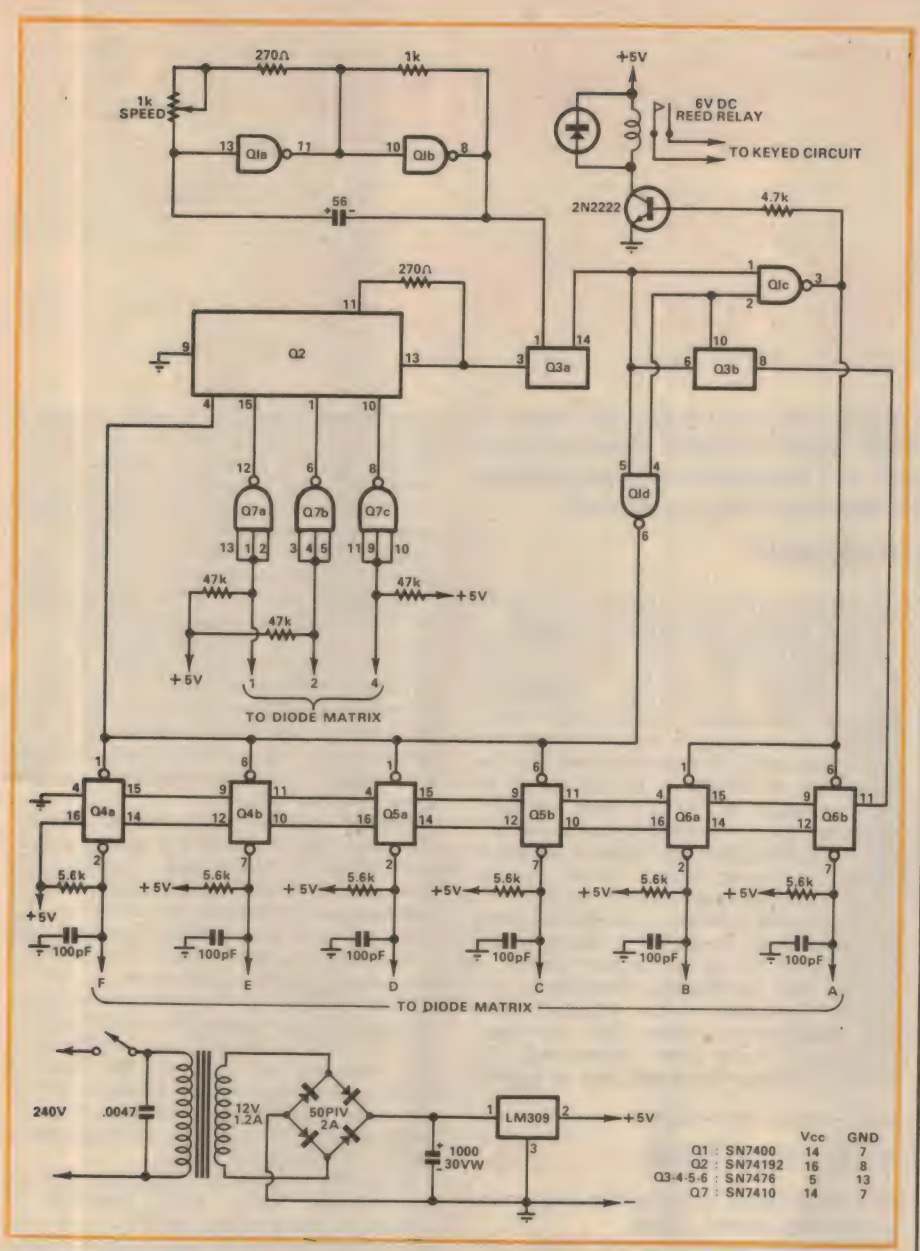


Fig.5: The circuit for the electronics section of the keyboard, with the connections to the diode matrix indicated. T1 is a 12V 1.2A type.

Cut two equal size pieces of the Vero board so that at least nine copper strips run horizontally on one board and forty or more run vertically on the other. Drill two sets of mounting holes and mount the boards together with spacers so they are parallel and about one inch apart. Nine strips on one board will represent the nine data word bits and the forty-odd strips will be connected to the individual keyboard contacts. Push the diode leads through the holes from the center of the two boards and bend the leads so they will not drop out. See Fig. 3. Arrange the diodes as shown in Fig. 4 and 1. When all the diodes are inserted, carefully check your work, and then check it again. Once it is determined that the diode board is correct, remove the spacers and push the boards together. Solder all the leads, being careful not to use excessive heat.

Once the keyboard sender is complete a certain amount of skill is required to send perfect Morse code. Although the keyboard resembles a typewriter, the operation is somewhat different. Only a few hours are required to develop the skill needed to send excellent Morse.

My unit is very light and quick and can send faster than any man can copy. One word of caution is appropriate — don't forget the meaning of QRS!

Editor's note: This article has been reprinted from the US magazine "CQ", by arrangement. Understandably, some of the exact components used may not be readily available in Australia. For example, surplus keyboard may be rather difficult to come by in this country. However keyboard switches are readily available from a number of suppliers, as are also complete keyboards. One company able to supply either is General Electronic Services, of Crows Nest, NSW, who advertise regularly. In place of the 2N2222 relay driver transistor specified, it would probably be permissible to use a TT801 or similar. In any case it would be desirable to fit a spike suppressor diode across the relay winding (anode to collector end), to prevent possible punch-through damage.

Simple AF oscillator offers low distortion

A low distortion audio oscillator is a very useful instrument in any laboratory or workshop, especially where it is desired to make distortion measurements. The oscillator described here is very simple and straightforward, yet provides an output with almost negligible distortion over the full audio spectrum.

by F. G. CANNING*

Of the principal methods for measurement of distortion in electronic circuits, the true Harmonic Analyser tends to be too expensive, slow and difficult to handle for the purposes of the modest laboratory. The alternative, the Distortion Factor Meter, which measures the effective total of all harmonics present without giving their individual amplitudes, is generally simpler and cheaper and also easier to operate. This is perhaps the reason for the increasing tendency in recent years to express the performance of circuits in terms of total harmonic distortion as a percentage of the output signal at stated levels and frequencies.

The starting point in making such measurements must necessarily be a signal source, tuneable throughout the frequency range to be investigated and with controllable output level, whose signal is virtually distortionless. At least any residual distortion in its output must be well below that of the circuit being measured, if it is not to contribute its quota to the overall figure. The alternative, if the signal is not pure, is to use sharply-tuned filters between the source and the circuit under measurement to eliminate all possible harmonics and leave only the fundamental frequency; this makes for an expensive, slow and "fiddling" procedure if measurements are to be made at many frequencies.

The audio-frequency source to be described is believed to fill most of the requirements outlined and is well within the capabilities of any serious experimenter. For anyone who does much audio-frequency work it may prove one of the most useful items on his bench, especially if the other equipment includes even a simple cathode-ray oscilloscope, though this isn't essential.

The circuit is shown in Fig 1. It consists of a Wien bridge driven by a three-stage DC-coupled transistor amplifier, whose oscillation amplitude and output is stabilised by a vacuum-type thermistor, type R53. This is a type produced by Standard Telephones & Cables Ltd (STC) especially for low-power applications and having a power consumption of about 0.5 milliwatt only; it is extremely effective in this kind of application. Its special property is that its resistance falls rapidly with a small increase of current flowing through it.

It will be seen that positive feedback is AC-coupled from the output back to the base of Tr1, through S1b and one branch of the Wien bridge, to sustain oscillation. However, the output signal is also back-coupled in a negative sense through the thermistor and C1 to the emitter of Tr1. The thermistor is adjusted, by choice of its series resistor R7, to its most sensitive operating point, at which approximately 1 volt RMS of signal output appears across it. Should the output voltage across RV3 attempt to change appreciably from this level the thermistor resistance changes in such a direction as to increase or decrease the feedback to Tr1 to the extent needed to modify the oscillation amplitude and restore the output to the original figure. The specification shows that the compensation is very close indeed over the whole operating range and this is a great convenience, making unnecessary any monitoring voltmeter on the output and allowing the frequency to be changed as required with full confidence that the output level chosen by the setting of RV3 will be maintained and can virtually be forgotten. The same confidence applies to the harmonic content, so that for most practical purposes the only controls needing attention during a set of measurements are the coarse and fine frequency controls.

Tr1 and Tr3 are NPN types chosen for moderate gain, low noise and cheapness, and Tr1 is operated at a low collector current to minimise noise and to raise its input impedance to avoid undue loading of the bridge network. Tr3 is an emitter-follower serving chiefly to isolate the external load from the generator, to give a low output impedance and to provide feedback in the correct sense. Tr2 is a PNP amplifier stage and the specified transistor was chosen to ensure freedom from spurious oscillation in any part of the tuning range; its hFE should not be too great and its base current minimal. Stability is aided by a small high-frequency phase-shift network R11 and C12 across its collector load. Some DC negative feedback is supplied by R9 and R6 to further stabilise the overall operating points and to reduce the loop gain, since the gain needed to sustain oscillation is little more than x3 times.

Battery supply is preferred for this application chiefly because a mains supply unit would probably need exceptionally good and elaborate filtering to keep out hum and noise, remembering that 100 microvolts of hum or noise superimposed on the output would be considerably more than the total harmonic distortion generated by the instrument itself. The constancy of output voltage and of frequency is well maintained down to half the nominal supply of 18 volts, but distortion will begin to rise below 15 volts, so batteries should be discarded at this point. Higher supply voltage up to 24 volts can be safely used if the voltage rating of C1 is increased to suit.

Distortion may rise a little at the very low frequencies below 30Hz because of capacitor phase-shifts and because the thermistor element is increasingly able to follow and try to correct the individual cycles of current output instead of averaging them, but down to 20 Hz it does not rise, in the prototype, above 0.008pc.

This instrument shares one minor disability with the majority of thermistor-stabilised oscillators, in that the output voltage tends to "hunt" a little, or bounce up and down, for a short period after any frequency adjustment, especially below about 100 Hz. However at the worst it lasts only for a couple of seconds and is no real drawback as the output always returns to the correct figure. The mechanism of the effect is a little complex and hardly worth explaining here. If this momentary "bouncing" of output is observed on a meter or oscilloscope, do not assume that anything is wrong; over the bulk of the frequency range it will be unnoticeable.

Coarse frequency tuning is controlled by switch S1, which brings into circuit two precision fixed capacitors on each range, with in all. These should be of ± 1pc tolerance and of the plastic film type for stability and low leakage. 50 working volts rating is sufficient but higher ratings usually mean greater reliability, physical size permitting. R3 and R4 should also be of

SPECIFICATION

Frequency Range: 10 Hz to 100 kHz, in four overlapping decade ranges
Output: Approximately 1 volt RMS, constant to within 0.1 dB irrespective of frequency from 20 Hz upwards
Total Harmonic Distortion: Less than 0.01pc at 1 kHz (average measured value below 0.005pc)
Output level: Controllable by single attenuator down to zero. Readable attenuation range 26 dB.
Output impedance: 1000 ohms approx. Can be made 600 ohms if preferred
Power supply: 18 volts from batteries. Drain 12 mA

* 30 Back Beach Road, Portsea, Victoria 3944.

± 1pc tolerance. It should then be possible to calibrate the fine frequency dial (on RV1 and RV2) on a single frequency range and have the calibration hold good pretty closely on the remaining ranges.

The fine frequency control will be a dial carrying a blank scale, or a pointer moving over such a fixed scale, upon which the calibration marks can be inked in or applied by adhesive lettering. It operates RV1 and RV2, a two-section ganged wire-wound linear potentiometer, each section of 10,000 ohms. Carbon-track controls are not generally suitable for this work, accuracy of resistance and tracking being inadequate. With R3 and R4 chosen as 1k, the resistance ratio, maximum to minimum, is 11 to 1 and as frequency is directly proportional to resistance in this type of circuit each range has a coverage of 10 to 1 with a small overlap between ranges. A more open scale can easily be had by increasing R3 and R4 as desired, but overlap between switch positions is then lost unless extra switch positions and capacitors are used together with a multi-range calibration. The scale shape will be far from linear, crowding occurring at the high-frequency end, but this is practically unavoidable in the absence from the market of tapered wire-wound potentiometers.

The output level control is a linear wire-wound potentiometer and can be easily provided with a pointer knob and a scale graduated in ten main divisions and ten intermediate half-divisions, giving a readable attenuation to 26 dB without need of measurement. Alternatively a scale calibrated directly in dB could be made if a dB meter is available to measure the output; in that case R13 might best be changed to 600 ohms. This will slightly reduce the overload margin on short-circuited output but will not otherwise affect performance. A calibrated ladder-type attenuator of 600 or 1,000 ohms could be added without ill-effect by anyone who feels it necessary to have a constant-impedance network, but the existing arrangement, supplemented occasionally by a simple potential-divider made up of carbon resistors of known ratio connected across the output, will do all that is normally needed.

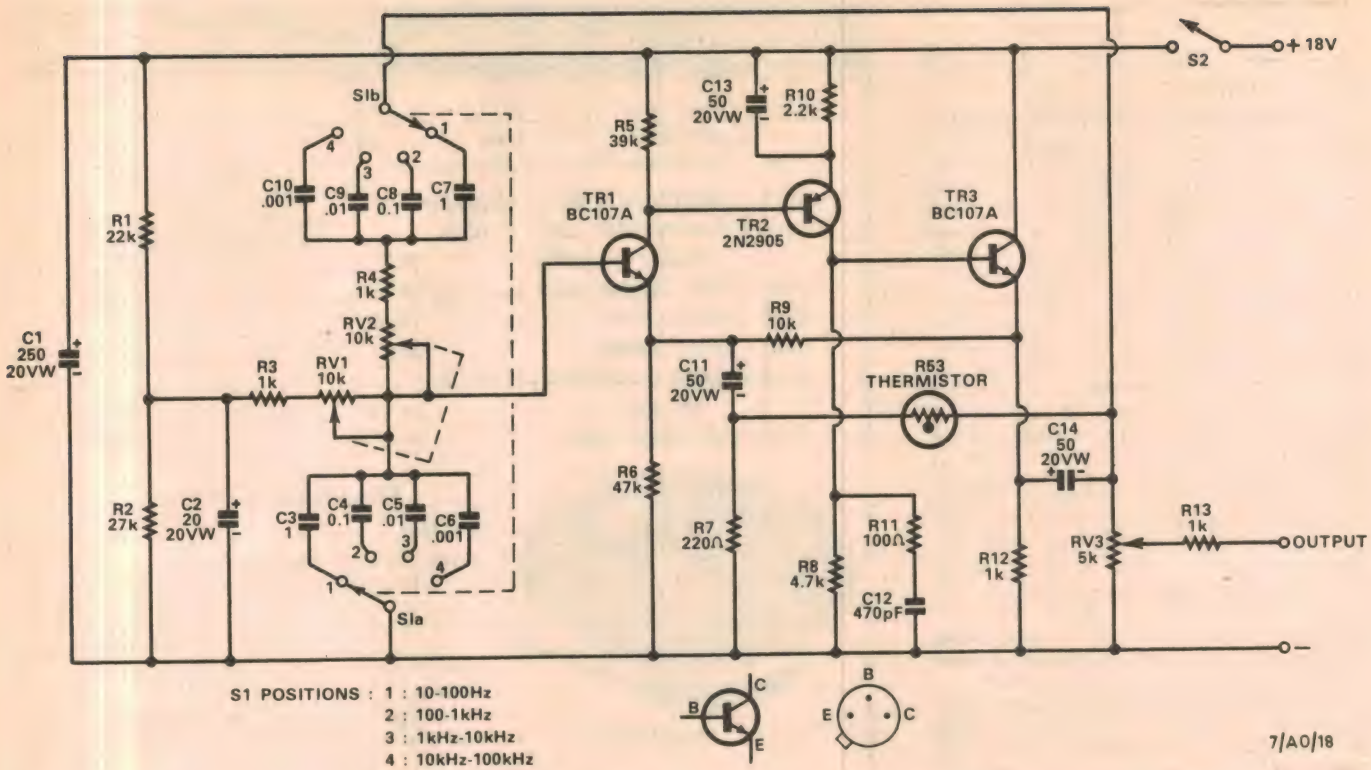
An outline of the design procedure for this instrument may be helpful to those who may need to do similar work for themselves.

1. As with other circuits involving amplification, one starts at the output stage and estimates the load which it must drive. In this case, where the output is to be 1 volt RMS (this being the normal level for the R53 thermistor) we have to consider what will be the worst condition (lowest load resistance) which Tr3 will see. This will occur when the instrument is feeding a virtual short-circuit, or a circuit of very low input impedance, with the output control RV3 at maximum. It will then be between 200 and 250 ohms, represented by the parallel combination of R12, RV3, R13, and the thermistor and bridge network. So the peak alternating current in Tr3 emitter will be, in the worst case,

$$R = \frac{1.4V}{200} = 7.07 \text{ mA}$$

To be sure that this drive will be available without distortion we will bias Tr3 to produce 9 to 10 mA of emitter current.

2. As usual with class A output stages, we arrange for roughly half the supply voltage to appear across the load resistor, so R12



The circuit of the oscillator. As may be seen, it uses only three low cost silicon transistors, together with a vacuum thermistor.

becomes, say,

$$R = \frac{9V}{9\,mA} = 1k$$

3. A rough rule-of-thumb which is usually satisfactory with emitter-followers is to make the collector load of the preceding stage (Tr2) about five times the emitter-follower load. So R8 becomes 4.7 k (nearest preferred value). R10 can be about half of R8, again by rule-of-thumb, therefore 2.2k.
4. We must now bias Tr2 to such a collector current that the voltage drop across R8 equals the voltage across R12 plus the internal base-emitter voltage drop of Tr3, which will be, as for all silicon transistors, about 0.6 to 0.7 volt. Therefore Tr2 collector current Ic2 must be

$$\frac{9.7\,V}{4.7\,k} = 2.06\,mA$$

The emitter current of Tr2 will also include the base current of Tr3 (measured as 140 microamps). Therefore the voltage across R10 will be

(Ic2 + Ib3) x R10 = 2.2 x 2.2 = 4.84 volts.

At this point we measure or otherwise determine what is the base current of Tr2 under the conditions so far established; for the 2N2905 it is around 12 microamps.
5. As mentioned earlier, it is desirable to operate Tr1 at low collector current. A likely figure would be 150 microamps for the BC107A / 107. So the value of its collector resistor R5 will be

$$\frac{\text{Volts across R10 + Vbe of Tr2}}{\text{Collector current Tr1 — base current Tr2}}$$

(the Ib of Tr2 is subtracted because this is a PNP type whose current flow is in the opposite direction.)

$$\text{Therefore, } R5 = \frac{4.84 + 0.7}{150 - 12} \times 10^6 \text{ ohms}$$

$$= 42k$$

Take the nearest preferred value, 39k.

Tr1 emitter resistor R6 should drop roughly the same voltage as R12 or a little less, since they are connected through R9; ie, around 8 volts. Therefore

$$R6 = \frac{8V}{0.138\,mA} = 56k \text{ roughly.}$$

However, there will be some additional voltage drop from current coming through R9 from Tr3 emitter, so 47k will be satisfactory.
6. R1 and R2, comprising the base voltage divider for Tr1, can now be selected to give a bias of around half the supply voltage, ie the voltage across R6 plus the internal Vbe of Tr1, so 8 to 9 volts plus 0.7 volt — say 9.2 volts. Their actual values are unimportant but there is no point in wasting current by making them too low, so a combined resistance of around 50k is chosen. Because this circuit is DC coupled, varying the bias of Tr1 affects all currents and voltages in all stages to some extent and adjustment of this bias by varying R1 relative to R2 gives a convenient way of finally settling the important currents, especially that of Tr3, to the designed values. The values for R1 and R2 shown in Fig 1 were found correct in the prototype.
7. R9 is not critical in value provided it is high enough to avoid heavy shunting of R12 but does not approach R6. The figure shown is satisfactory.
8. R7 is chosen experimentally to bring the thermistor to the required operating point;

THE PARTS NEEDED TO BUILD IT

1 Toggle switch, SPDT
1 Rotary Switch, 2-pole 4-position, shorting or non-shorting
2 Terminals, or phono jack and plug
1 Metal or shielded wooden case

SEMICONDUCTORS
Tr1 BC107A or BC107
Tr2 2N2905 or 2N2906
Tr3 BC107A or BC107
1 Thermistor, STC type R53

RESISTORS (All ½ watt carbon film, 5pc tolerance unless otherwise stated)

R1 22k	
R2 27k	*R8 4.7k*
R3 1k	*R9 10k*
R4 1k	*R10 2.2k*
R5 39k	*R11 100 ohms*
R6 47k	*R12 1k*
R7 220 ohms	*R13 1k*

RV1 / RV2 Twin ganged linear wire-wound potentiometers, 10k each
RV3 Linear wire-wound potentiometer, 5k

CAPACITORS
C1 250 uF electrolytic, 20 VW
C2 20 uF electrolytic, 20 VW
C3, C7 1 uF 1pc, 50 VW or more
C4, C8 0.1 uF 1pc, 50 VW or more
C5, C9 .01 uF 1pc, 50 VW or more
C6, C10 1000 pF 1pc, 50 VW or more
C11, C13, C14 50 uF electrolytic, 20 VW
C12 470 pF mica, 10pc

MISCELLANEOUS
Dial or Pointer and knob
Two pointer-type knobs
Two 9 volt batteries, type 2362 or larger
Connection leads for batteries
Tag strips or Veroboard, 0.15in matrix
Wire, screws, etc.

TABLE 1	
FREQUENCY, Hz	RESISTANCE (RV1 plus R3)
20	7960 ohms
25	6370 ohms
40	3990 ohms
50	3150 ohms
60	2652 ohms
80	1992 ohms
100	1592 ohms
120	1326 ohms
140	1138 ohms
150	1050 ohms

TABLE 2		
VOLTAGE AND CURRENT ANALYSIS (18 Volts SUPPLY)		
Tr1	Ic (at collector) Ib Ve Vc Vb	130 microamps 1 microamp 9 volts 13 volts 9.6 volts
Tr2	Ic Ib Ve Vc (from minus rail) Ve (from minus rail)	2.0 mA 12 microamps 4.4 volts 10.4 volts 13.7 volts
Tr3	Ic Ib Ve	9.7 mA 140 microamps 9.7 volts
All voltages measured with 50k / V meter		

it can also be derived from the characteristic curves of the thermistor if available.

9. If other frequency ranges are wanted, the required bridge capacitors can be calculated from the following formula:

$$C \text{ (in farads)} = \frac{1}{2\pi FR}$$

R being the sum of R3 and RV1 and F being the lowest frequency required on that particular range.

Now for the actual construction of the unit. There is nothing critical about the layout and the construction can be either on tag-strips or on Veroboard of 0.15in matrix. The considerable extra work involved in a printed circuit layout isn't worthwhile unless a number of instruments must be built. Some kind of metal cabinet, or a metal-lined wooden one, is needed and the author's preference is for one having a sloping front panel at about 60 deg inclination giving good lighting and easy dial reading without bending and peering.

Shielding is advised because of the need to keep out interference which may otherwise appear on the output signal; for the same reason it is best to house the batteries inside the shielding case. A surprising amount of broadcast station interference can be picked up on exposed batteries and leads in many locations and can give rise to intermittent noise, beats and other puzzling effects on the signal output, all likely to be interpreted by the measuring instrument as distortion.

While on this subject, keep the instrument well away from the AC fields associated with oscilloscopes, large power transformers and smoothing chokes, and beware of fluorescent lighting in the room or vicinity; all can produce spurious effects that can be mistaken for distortion.

The signal output should be taken from a shielded co-axial connector (the humble "phono socket" and matching plug are quite effective and cheap) through a short shielded cable of reasonably low capacity to the apparatus being measured, which may or may not benefit by being earthed — only trial can tell.

The panel layout falls naturally into a symmetrical form with the dial or pointer of RV1 / RV2 centrally placed and given the lion's share of space to permit a big clear scale, flanked on one side by the range switch and on the other by the output attenuator and output terminals or jack. Fig 1 shows terminals, for convenience and flexibility of connections, but a jack and plug with screened cable is probably safer — see above.

Two 9 volt transistor-receiver batteries connected in series are needed and they should not be of the smallest size in view of the 12 mA total drain. Eveready No 2362 or similar is the smallest that can be recommended.

Now for a few words on calibration. Precise knowledge of frequency to a fractional percentage is not often needed from an audio generator and for those who cannot beg, borrow or steal another of known accuracy for comparison, there are a few alternatives which may be good enough. For example, if the bridge capacitors are of the specified tolerance or closer, a scale of good accuracy can be made in terms of the total resistance in one arm of the bridge at each specified frequency, ie, RV1 plus R3. For those with access to a resistance bridge or a really accurate ohm-meter, therefore, Table 1 is given showing this measured resistance for several frequencies from 20 Hz to 150Hz. The same scale, multiplied by the appropriate factors of ten, should then be satisfactory for the remaining ranges.

Another alternative for anyone with record-playing equipment would be the use of one of the several standard-frequency records which are available, mostly to special order, from major record companies. The type of disc needed is that which carries many discrete steady frequencies, not the so-called "gliding tone" type, which are useless for this purpose. The outputs from the generator and from the record-playing amplifier are fed, each through an isolating resistor of a thousand ohms or so, to a mixer which may be any rectifying device, such as a silicon or germanium diode, a vacuum-tube voltmeter, etc. The amplifier output could be taken from across the speaker voice-coil. If a diode is used, a DC milliammeter is connected after the diode, with a capacitor of about 0.01uF across it, to the common earthy line, and the two signals when thus mixed should produce "beats" in the form of pointer swings as the generator is brought very close to the standard frequency, until at exact equality the pointer remains stationary or nearly so. A pair of headphones or a small speaker connected across the meter will aid in preliminary searching for synchronism. In the case of the VTVM its own meter will indicate the perfect tune point by its pointer swings. An oscilloscope, if available, can of course be used as a very accurate comparator; one method would be to use the oscilloscope to calibrate some points on the lowest frequency range in terms of the 50Hz mains, using the method of Lissajous figures.

This is too complex to deal with here but is well described in many standard texts; however, any attempt to extend it to the higher frequencies needs care to avoid false interpretations and it is tedious to get a sufficient number of calibrations from a single frequency such as the mains. However, it can be done if the lowest scale is first calibrated with the three most easily available points, namely, 50, 100 and 150 Hz (the latter may just be reached on range 1). The 100 or 150 Hz point is then picked up on the next higher scale and the calibration continued upward from that point at 50 Hz intervals, which will at the same time provide intermediate points for the lowest scale, and so on.

(Continued on page 125)

Australian Science Education Project

A new experiment in education is currently being conducted by the Australian Science Education Project. The Project has produced a series of science teaching packages or "units," each incorporating new techniques to make the learning process more efficient. Preliminary feedback indicates that the ASEP approach is working well and will have a major impact on Australian teaching practices.

The Australian Science Education Project (ASEP) was financed by the Commonwealth and State Governments to the extent of $1,400,000 over a five year period from October 1st, 1969. It is the first educational program to be initiated on a national scale in Australia for almost fifty years.

ASEP could be described as a "task force of teaching talent," assembled under the auspices of the Federal Department of Education and the various state education departments. When the five-year project is completed at the end of 1974, ASEP will have produced 40 units on subjects relevant to the teaching of science and social studies in high schools.

The basic philosophy behind the ASEP approach to teaching is that science and its processes are interesting to the child when they provide a useful way of making sense of his environment. In general, junior secondary syllabuses in Australia attempt to present science as an integrated subject. This aim is usually met with a limited amount of success, and the various components, eg physics, chemistry and biology, remain as separate identities.

The ASEP approach is to emphasize the environment so that a unification of the sciences occurs naturally. Briefly, the scheme relates the child to his environment by having him explore: (i) himself as an individual; (ii) himself as group member; (iii) the extensions of his physical and mental self; (iv) the technology of his environment; and (v) the natural environment.

Instead of an inflexible sequence of material, or a text, ASEP developed a series of unit topics. Each unit is a complete teaching package containing material for teachers and students sufficient to cover several periods. Latest techniques are used to make the learning process interesting and effective, with emphasis on student activities, relevance to life, and self-teaching at a pace appropriate to student needs.

Most units have a core which will occupy up to about one quarter of the total time to be spent on the unit. All students are expected to attain a minimum level of competence on this core material. The remainder of the time on the unit is spent working on a number of the options offered. There may be as many as twelve of these options, of which the average student may do only three or four. Students are expected to pursue their own interests in these options.

After acceptance of a unit topic, each unit was developed by a staff member working in conjunction with a content specialist and a research officer. The unit was then produced and printed ready for classroom trial. Two classroom trials were planned for each unit.

The purpose of the first classroom trial was to test the validity of the materials in an actual teaching situation. Close attention was paid to errors, inconsistencies, and inadequacies in the materials as revealed in the classroom. During this period the materials were also subjected to close scrutiny by scientists and science educators. Evidence gathered from the first trials was used as a basis for revision of the materials for a second trial, this time on a national basis.

The over-all purpose of the national trials was to test the validity of the materials and to disseminate information on ASEP. These trials have provided a nucleus of teachers experienced in ASEP philosophy and the use of ASEP materials. Through this experience, the states have been able to implement a national teacher education program for the use of published ASEP materials.

In producing each unit ASEP allowed for

Group discussion of a project provided by ASEP is shown at left. Above, two students closely examine ASEP material.

A step back in time puts the study of petroleum into a new perspective. This is illustrated by these scenes from the film "The Extraordinary Experience of Nicholas Nodwell", made by the ASEP team with assistance from the Petroleum Information Bureau. (Photographs courtesy PIB).

three stages in the intellectual development of junior secondary students, and developed materials to suit students at each of these stages. Units for students at stage 1 explore the environment through direct experience ie, there is a direct and immediate relationship between the experience and the idea being developed. Student activity in real situations provides the major source of motivation and experience.

Stage 2 materials are for those students who are in a transitory stage in their intellectual development. Units for this stage are largely activity based, but provide students with an opportunity to explore more formal or abstract modes of thinking.

Stage 3 materials are for those students who have reached the formal stage in their intellectual development. These students can manipulate ideas mentally without recourse to concrete experience, and can handle more abstract thought. Second-hand data may be used, and extrapolation from one situation to another without recourse to the physical reality of the second situation is possible.

Of the forty units produced by ASEP, there are seventeen stage 1 units, fourteen stage 2 units, and nine stage 3 units.

One unit presently being prepared by the ASEP team, with assistance from the Petroleum Information Bureau (PIB), will lead students to discover how petroleum affects their lives. Although not actually part of the unit itself, a short colour film entitled "The Extraordinary Experience of Nicholas Nodwell" has been produced to serve as an introduction to it in the classroom.

The idea behind the film treatment was to give students a new perspective on the benefits of petroleum; benefits which, unavoidably, they tend to take for granted. The "experience" of Nicholas Nodwell is to have these benefits withdrawn in a fantasy situation. The students are shown that you can get along without petroleum, but only at a price. Above all, they learn that if energy does not come in a convenient and versatile form from fuel of mineral origin, it can come at present from only one other source — muscle power.

All schools with access to a film projector will be able to use "Nicholas Nodwell" to introduce the ASEP unit on petroleum. The film should be available for borrowing later on in the year. With special funds made available by the Australian oil companies, the PIB will produce sufficient prints to meet the expected demand for the film from education department libraries and state film centres.

ASEP has achieved a number of purposes besides those formally stated. It has provided a group of people with experience in the development of curriculum materials and the evaluation of classroom instruction in a project of national scope.

Interstate co-operation and the exchange of ideas on curriculum matters at a national level have also been fostered. Finally, the project provided a well documented story of an experiment in curriculum development which will be valuable for future planning in education.

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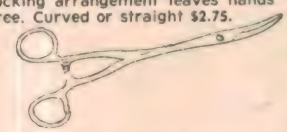

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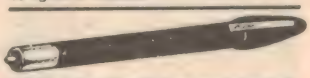

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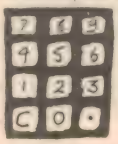

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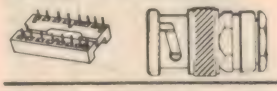

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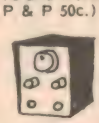
Kits ET 100W Amp (ET Dec 72) for guitar use etc. This kit is a Superkit, don't confuse with cheaper kits, our's has heat dissipating paint, predrilled heatsinks, silicon grease etc. Response 20Hz to 150kHz with 0.5% distortion at 80W. **$65** (P & P $1.50).

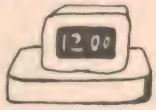
★ **P & P minimum 30 cents.**

If you missed Dick's catalogue last month . . .

Kits

Sperry Digital Clock Kit (E.A. Sept 73) Based on the Sperry Gas readout and National integrated circuit, this kit provides full 24 hour mains operation. All parts are included in the kit except the metal work (we thought you'd prefer to make your own). Full kit **$49.00.** Special Sperry/National offer of readout, IC and transistors only **$28.75** (Both P & P 50c.)

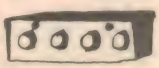




Headphone Adaptor (E.A. Aug 73) provides two sets of headphone outputs or speakers or both to be operated simultaneously. Separate left and right control from this very versatile unit. Full circuit details included etc. **$18.95.**

Courtesy light delay (E.A. June 73) simple little kit mounts on an 18 pr tagstrip and suits any vehicle. Keeps the interior light on for a short time after the doors have been closed enabling you to locate the ignition key, fasten seat belt etc without fumbling in the dark. **$4.25.**

Dick Smith Decision Maker (see E.A. June 73). As used by himself and good for a laugh. Ingenious circuit uses 3 transistors, 2 LEDs and diode switching. Handsome panel with jingle. Uses 9V transistor battery. Complete kit only **$8.75.**



Musicolour (EA Dec 72). Watch the colour lights dance to the sound of music from your Hi Fi etc. Drives reflector globes etc up to 1000W per channel. Attractive front panel etc. Value at **$52.00** (P & P $1.00).
FET Four input Mixer (ET 25 Top Projects). Ideal for guitar enthusiasts, groups etc. Handles mics, record players, tapedecks, organ etc. Inputs from 2mV — 2V, impedances 40hm to 1Meg 20db max gain 3V max output 100hr battery life. Beaut metal case. Complete kit **$24.50.**

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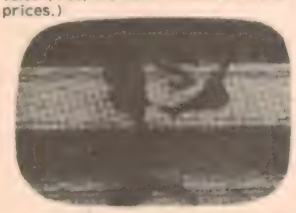

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The Homodyne tuner: another approach

Due to problems with supplies of suitable ICs for the homodyne tuner described in June and July last, the author has developed an alternative version. Although simpler than the original, it will be of interest to many readers, particularly those who are experimentally inclined.

by J. W. HERBERT, ZL2BDB*

In the June issue of Electronics Australia the author discussed the principles of the "homodyne" method of reception and followed with a practical broadcast band tuner using ICs in the July issue. Unfortunately the detector IC specified (the Motorola MC1330P) is temporarily out of stock in both Australia and New Zealand and further supplies will not be available from the USA for some months.

This situation appears to be part of a general world-wide shortage of many types of ICs due to a resurgence in the electronics industry. As there is no direct substitute for MC1330P available and because of an apparent ready demand from hobbyists for a circuit that can be assembled using more readily available semiconductors, the author has developed an alternate version of the Homodyne Tuner employing field effect transistors in place of ICs.

Although readers are referred to the original articles for detailed discussion of the basis of design, briefly the operation of this circuit is as follows:

T1 is a junction FET RF stage whose output is coupled in parallel paths to T3, a product demodulator and T2, the second RF amplifier-limiter. The output of T2 is tuned to the incoming signal but amplitude variation (i.e., modulation) is limited by the shunt diodes D1 and D2, giving a carrier of about 1 volt peak-to-peak for injection to Gate 2 of the dual gate MOSFET demodulator.

The output from the demodulator is a relatively low-level audio signal which is amplified by transistor T4 before feeding an external power amplifier. The emitter circuit of T4 has an adjustable negative feedback control (P1) which is used to set the audio output level to the minimum acceptable to the following amplifier.

The printed board layout is to the same dimensions as the IC version and employs the same tuning unit. Alignment is quite simple, as L1-C4 determine the tuning range while L2-C9 may be set adequately by adjusting for best audio quality. It is normal to adjust the trim capacitors C4 and C9 only, as the permeability tuning unit is supplied pre-aligned.

Unfortunately this tuner has no AGC facility as had the IC version but in practice the dynamic range of the MOSFET detector has proved to be such that it is able to handle a large variation in station signal level without affecting operation. Adjustment of audio levels from station to station is therefore by means of the main amplifier volume control. An audio derived AGC was attempted at one point of the development but was found to be generally unacceptable on musical programs.

Editorial note: Soon after it became known that there were problems in obtaining the type MC1330P IC specified for

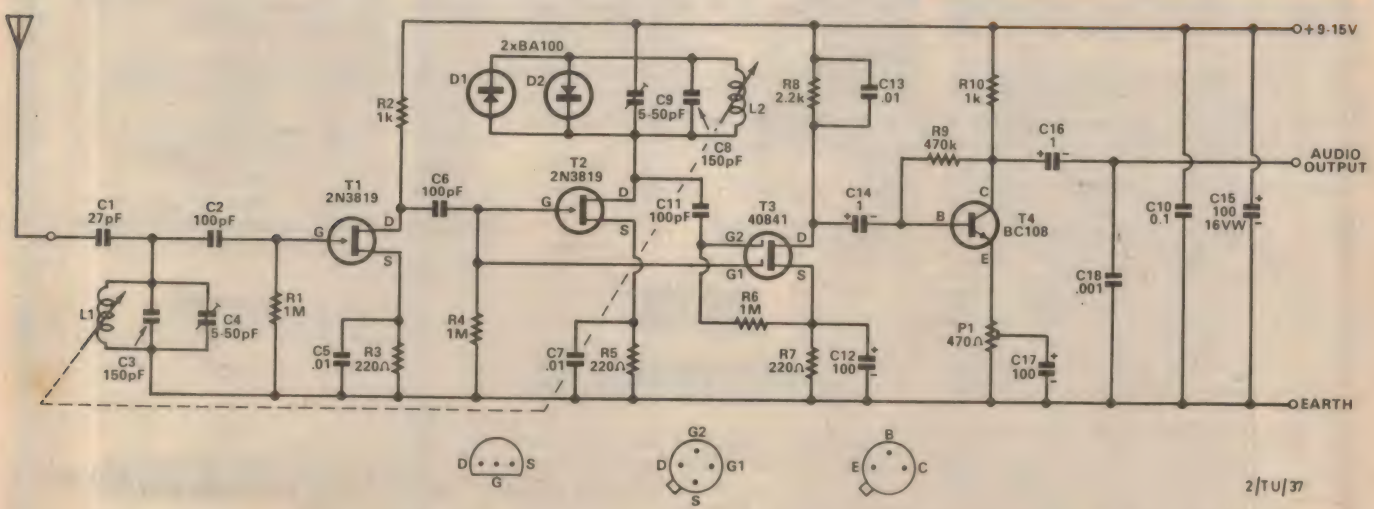
*Department of Electronic Engineering, Central Institute of Technology, Petone, New Zealand.

PARTS LIST

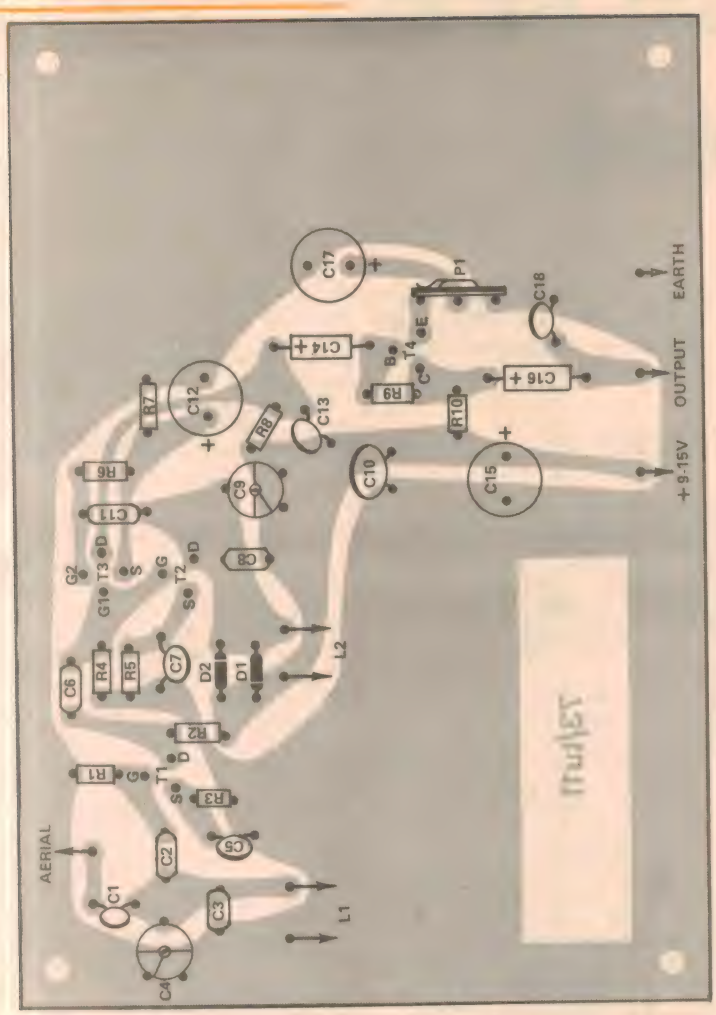
1 Permeability tuner, "Q" Inductance 164, or similar
1 Printed board, 73 / tu11
1 Dial assembly, as required
1 Set of metalwork, as required
1 Transistor, 40841 (RCA)
2 Transistors, 2N3819 (Texas)
1 Transistor, BC108
2 Diodes, BA100

RESISTORS (½ watt)
3 220 ohms
2 1k
1 2.2k
1 470k
3 1M
1 470 ohms trim pot

CAPACITORS
1 27pF NPO ceramic
2 5-50pF Philips trimmers
3 100pF polystyrene
2 150pF polystyrene
1 .001uF polyester
3 .01uF polyester
1 0.1uF disc ceramic
2 1uF tantalum or 160V polyester
3 100uF 16VW electrolytics



The circuit of our contributor's alternative Homodyne tuner design. It is still quite simple and easy to build, but lacks the AGC facility provided by the original design. Sensitivity may also be a little lower.



The board wiring diagram, with an overlay showing the copper pattern as seen through the board. The board is reproduced actual size to allow tracing.

the homodyne tuner described in July, 1973, and before we were advised of Mr Herbert's new design, we set about investigating the possibility of designing a similar type of tuner but using a readily available IC. The task was not an easy one but we have since overcome the obstacles and we have now completed the development of a very satisfactory unit.

Our tuner uses a National LM1351 IC, which is modestly priced, together with three transistors. The unit uses the superhet principle and features AGC, a 10kHz whistle filter and a tuning meter. There is still a considerable amount of work before it is ready for presentation, but we hope to describe it in the very near future.

We have prepared an artwork for a printed board for Mr Herbert's new homodyne and we are making transparencies available for 50c each so that readers may make their own printed boards. Application for transparencies should be made through our Information Service.

An alternative approach would be to make a tracing from the board pattern overlay on the diagram above, using carbon paper to transfer the pattern directly to the copper. Bituminous resist may then be used to fill in the copper areas to be retained, prior to etching. We have reproduced the above pattern actual size, to allow this to be done if desired.

Permeability tuning units suitable for this and the earlier version of the Homodyne are currently available from at least one Sydney supplier, Tudor Radio of 103 Enmore Road, Enmore, NSW 2042. Other suppliers may also have suitable units available. In some cases the value of the resonating capacitors across the coils of the tuning unit may have to be altered to permit tuning of the full broadcast band, depending upon the actual coil inductance.

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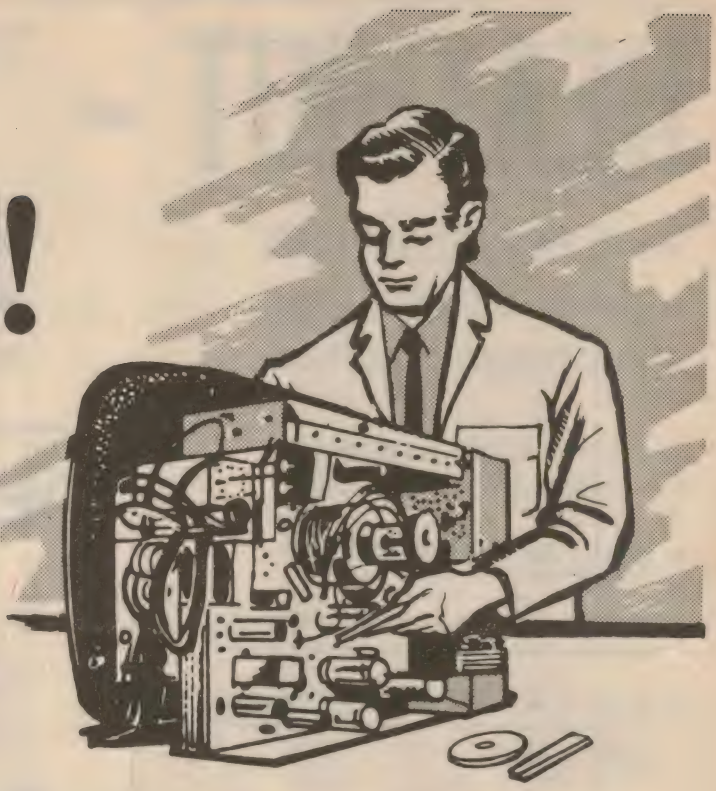

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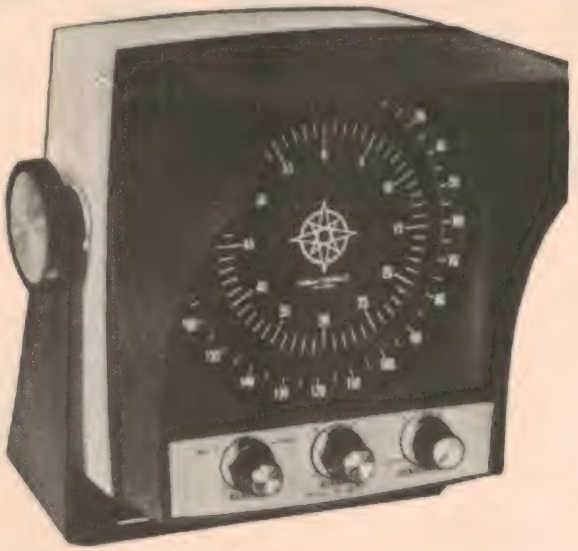

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Synchronisation of taped sound with home movies

This is the first of three articles dealing with electronic synchronisation between a movie projector and the sound track on a tape recorder. It is intended primarily for those readers with a silent movie projector who would like to provide synchronised sound.

by N. LABORDUS*

Most amateur movies are màde on double eight or super eight film material. Although it is possible to provide these films with a magnetic sound track, this is seldom done because of the expense involved and the fact that most people do not possess a projector with a sound system. The result is that most amateur movies remain silent.

In this article, ways are given to overcome this problem. Most people who can afford a movie projector also have a tape recorder and, by synchronizing the two, high quality film sound can be obtained.

Synchronising the speed of two units means that the speed of one is taken as a reference and the speed of the other is adapted to this reference. One cannot change the speed of a tape in this way without noticing distortions in sound. On the other hand, slight variations in film speed are not noticed by the eye. For this reason, in this and the following articles the tape speed shall be assumed to be constant and the speed of the projector shall be controlled by taking the tape speed as a reference. This is achieved by changing the value of a resistor connected in series with the projector motor.

Three groups of synchronisation systems will be described, all of which are basically different: non-discriminating control systems, discriminating control systems, and integrating control systems. Each system has its own characteristic advantages and disadvantages.

The apparatus that ensures synchronisation between projector and tape recorder is a controller. Any controller compares its input signal with a reference signal and, if these two are not the same, an output signal is given which in turn initiates a change in the unit that provides the input signal to the controller.

In Fig 1 the input signal of the controller is proportional to the speed of the projector motor. This signal is compared with a reference signal (also called "setpoint"), which is proportional to the tape speed. The resistor R1 is adjusted in such a way that under normal conditions the projector runs a little too fast. If the projector speed is the same (or lower) as required by the reference (full synchronisation) the output relay is not activated. If the projector speed reaches a value above setpoint, the output relay is activated and an extra resistor R2 is connected in series with the motor.

The value of this resistor is chosen in such a way that the speed of the motor drops below the required speed. As soon as this happens the relay falls off again and the speed of the motor increases again to a value higher than the reference.

If the resistance values are well chosen, the control relay will switch on and off in a regular tempo determined by the value of R1 and R2 and the inertia of the total system. Because of this the projector speed fluctuates around the reference speed. If no delaying elements are involved and the speed above and below setpoint are the same, the average speed of the film will equal that of the tape recorder whereby momentary deviations are too small to be detected (Fig 2).

The process of synchronising film and tape is a tricky one in a certain aspect. It is known as a non-stabilising process. Any deviation between the two speeds at a certain moment is added to a deviation at the next moment. The total deviation between sound and film increases as the integral of the momentary deviations (Fig 3).

If, for example, the film speed is slightly

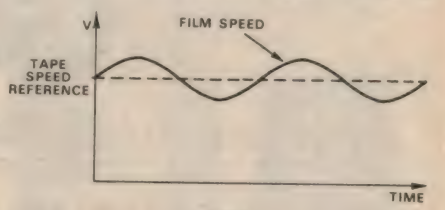


FIG. 2

higher than the tape speed, the sound will fall more and more behind the longer the film runs. For this reason it is of vital importance that nowhere in the control loop are any inaccuracies or delays introduced.

It is also for this reason that the speed signals are measured in a digital way in the form of a pulse frequency, rather than as an analog voltage where non-linearities can result in large integrated non-synchronisation. For the same reason, the on / off

* 1 Priestly Close, St Ives, NSW 2075.

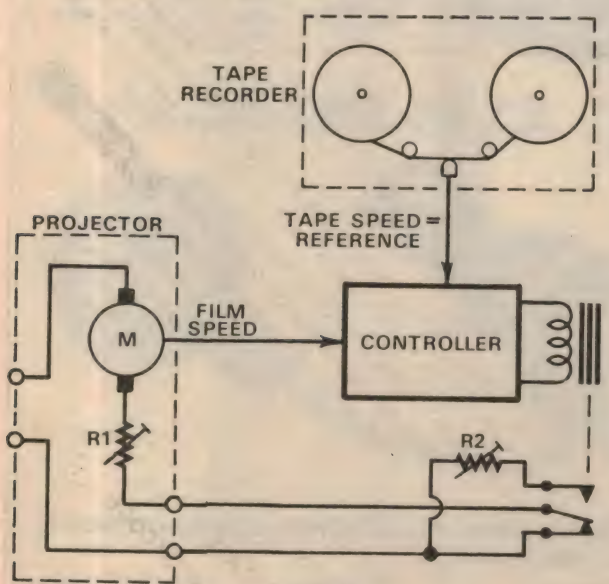


FIG. 1

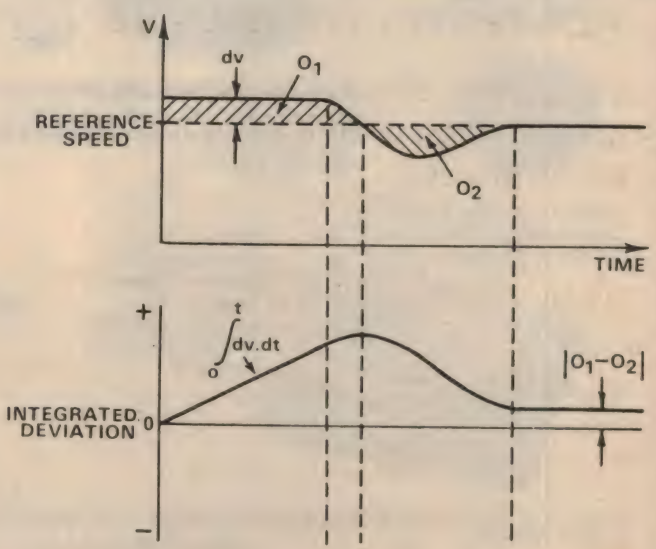
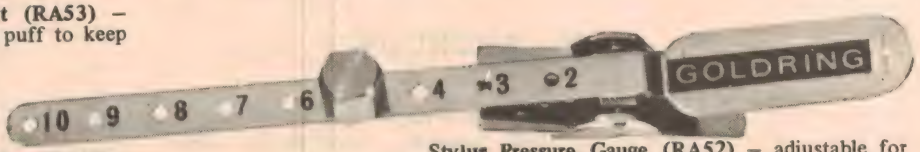


FIG. 3

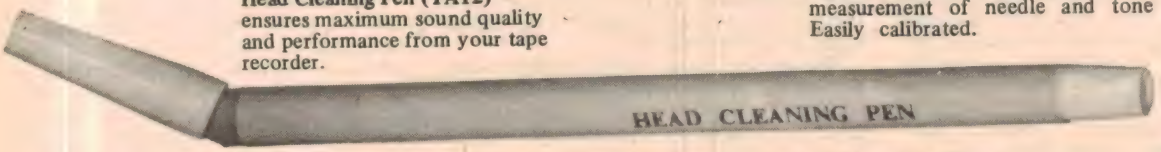
Record Anti-Static Cleaning Kit (RA53) – fluid, needle brush and cleaning puff to keep records clean and static free.

Replacement Dynamic Earphones (6' lead TA20 – 20' lead TA21) – for most transistor radios, tape recorders and T.V. sets.



Stylus Pressure Gauge (RA52) – adjustable for measurement of needle and tone arm weight. Easily calibrated.

Head Cleaning Pen (TA12) – ensures maximum sound quality and performance from your tape recorder.



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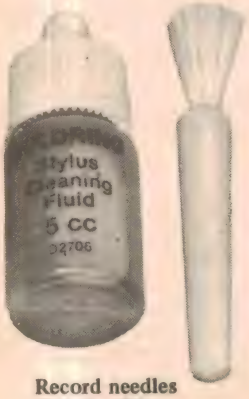
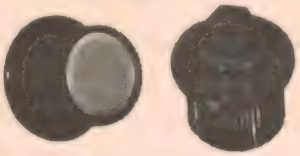


Record needles Cleaning Kit – (RA52) – cleaning fluid and brush successfully removes dirt and foreign matter from stylus point to restore 100% effectiveness.

Tape Recorder Head Cleaner (TA10) and Tape Head Cleaner and Lube Kit (TA11) – perfect for cleaning tape heads, removing dust, oxide and dirt particles.



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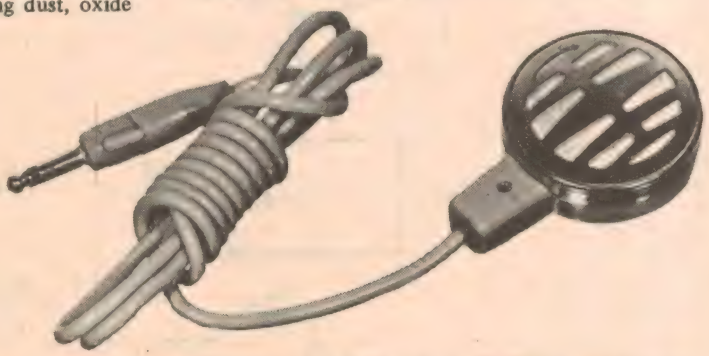

Crystal Lapel Microphone (TA19) complete with alligator clip, shielded plastic cable and plug.

Goldring Tape and Record Accessories – in exciting new display packs available from department stores, record centres and Hi-Fi shops everywhere.

Sound synchronisation

control technique, which acts without delay if properly designed, is chosen in preference to the more common analog (continuous) control techniques which would become rather complicated in order to overcome inaccuracies due to non-linearity and delays in the control mode.

The controller described before can only correct a deviation in one direction. It does not discriminate between "too fast," "just right" and "too slow" but only recognises "too fast." This group of controllers is therefore called "non-discriminating" controllers.

If the controller is modified in such a way that it can clearly discriminate between "too fast," "just right," and "too slow," this controller will be able to correct deviations in speed to both sides. In other words, it can slow down or speed up the projector motor or leave the speed as it is. This group of controllers is more flexible, but also more complicated. It is achieved by introducing a neutral zone between two setpoints which are very close to each other (Fig 4). The controller will try to keep the speed of the projector within the neutral zone.

If the speed deviates, the controller will activate one of its output relays, slowing down or speeding up the motor, thus bringing it back into the neutral zone. Normally, the controller shall only act around one of its contacts but, especially in the initial warming up period of the projector, it often happens that the projector speed is slow and gradually increases. In this case a "discriminating controller," as described, gives a better and more reliable performance than the non-discriminating one.

Both control systems described can achieve acceptable synchronisation, but both have a disadvantage which finds its cause in the non stabilising characteristics of the process. If for some reason the controller "slips" a few sync pulses, these are lost forever and the result is that for the rest of the film the sound is either behind or in advance. There is no "storage" of synchronisation signals on both sides. To overcome this, one can connect counters to both tape and motor speed signals and compare them, correcting manually when necessary. This system will be described later. It is however an emergency solution.

True synchronisation, whereby all errors are corrected, can only be achieved if sync pulses on both sides are integrated and the integrated values (rather than the momentary values) compared to each other (Fig 5). This group of controllers is therefore called "integrating controllers."

Next month, theoretical and constructional details will be give for a non-discriminating control system.

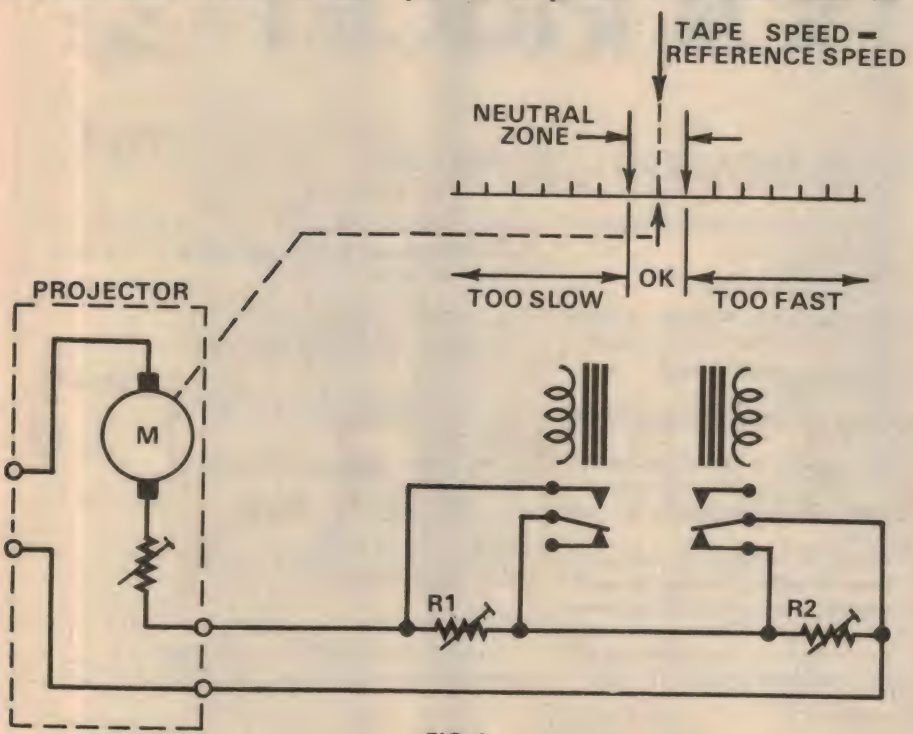

FIG. 4

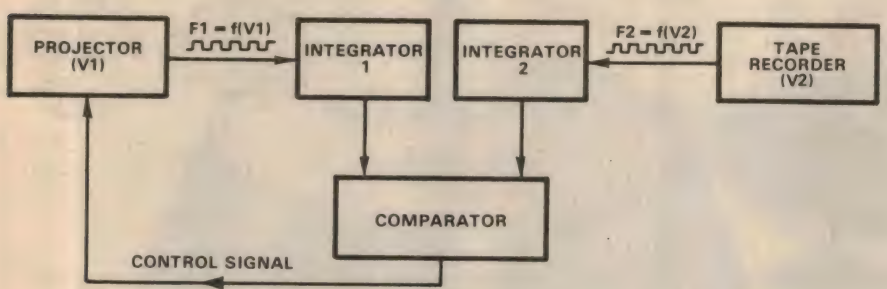

FIG. 5

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Sensitivity: 100.5 dB.
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6½" Wide Range Twin Cone 6WACX
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56327-002/15 ohms.
Ideal as an extension speaker for stereograms or tape recorders, etc.
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Frequency Response: 35 to 16000 Hz.
Voice Coil Impedances: 8 or 15 ohms at 400 Hz.
Compliance (Equivalent Volume): 2000 cubic inches.
Total Q: 0.33.
Sensitivity: 102.5 dB.
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A.D.29

FORUM

Conducted by Neville Williams

Let's make a "DIN" about audio connectors

For as long as I can remember, the matter of connectors and connections has provided one of the frustrations of the audio scene. The industry has been able to overcome all manner of problems in the design and marketing of equipment but we've never quite been able to rationalise the secondary problem of interconnecting that equipment.

As I said, I've been aware of the problem for a long time but, left to my own devices, I might not have got around to making an issue of it. But it is obvious that others have strong feelings about the subject and what follows is, as much as anything, an amalgam of what has been pur forward by readers and other members of the EA staff.

When I first entered the industry, it relied primarily on valve sockets and matching plugs for input and output connections. And what an array there was. We had 4-pin, 5-pin, 6-pin, two sizes of 7-pin and later the American octal. I leave it to you to work out how many possible ways there were of using those 6 sockets and 37 pins.

It's not stretching the point too far to suggest that no two companies and no two enthusiasts ever used them in quite the same way.

Then came World War II and the disposals era which fed into the situation a whole new array of connectors in addition to the valve socket variety. A fair proportion of these had been intended primarily for RF cables, but they were so plentiful and accessible that they ended up in audio service at both the commercial and enthusiast levels.

But, as ever, confusion arose from their very variety. Anyone involved with a range of audio devices tended to accumulate a festoon of cables intended variously to connect this to that, or to convert from this plug to that socket. They served their purpose for a while, then took their place on a hook on the wall, gathering dust and growing stiff with age — against the possibility that they might be needed later.

Nor am I dramatising this situation. It's only a few weeks ago that I consigned just such a cable festoon to the local tip, along with a lot of other useless junk.

In the face of such a situation, and of such sentiments, one might be expected to look with relief at the modern DIN-audio plug as the way out of such difficulties; as the answer to the audioman's prayer.

But is it?

To be sure, when the DIN plug first appeared on the audio scene, many of us were not impressed. We had seen too many connectors appear and disappear to be convinced that the DIN plug would provide the exception to the rule. And, anyway, the pins seemed to be altogether too frail and too close together!

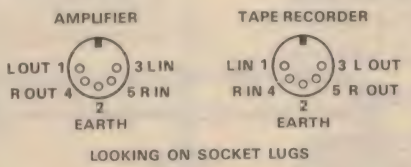

Fig. 1: Shown above is the now commonly accepted standard for DIN sockets fitted to amplifiers and tape recorders.

Since then, the DIN plug has won wide acceptance and this is a strong point in its favour. But has it really solved the confusion about connections? I doubt it.

In some ways, it has merely created a more orderly disarray!

To start with, it's wrong to talk about "the DIN plug" as a single item.

Without venturing beyond the commonplace, the familiar DIN audio shell may house 3 pins or 5 pins, or 5 pins in a different configuration. The old feeling of frustration returns when you look more closely at a DIN socket, only to discover that it differs from the plugs and cables you have on hand.

And, even if the two match physically, there is no guarantee that the same pattern of connections will have been used. All too frequently, one finds input and output connections interchanged.

Carelessness? Maybe, or maybe not!

Without having studied the origin of the aforementioned DIN connectors and the wiring conventions, it would appear that they have been heavily biased towards:
(a) the basic role of interconnecting an amplifier and tape recorder, and
(b) the idea of a straight-through cord, pin 1 to pin 1, pin 2 to pin 2 and so on.

To meet this concept, the basic connection pattern for plugs and sockets emerges, as in Fig 1. The vital point is that the pattern for amplifiers is a mirror image of that for tape recorders. It has to be, if the output of one is to connect straight through to the input of the other.

In an article in our December 1965 issue, staff writer Harry Tyrer indicated that a convention along these lines was becoming established but warned that a current sampling of European circuits had revealed plenty of exceptions.

Unfortunately the deliberate mirror image variation, plus the usual uncertainty about top or bottom view, provides generous scope for confusion. Official standards information is notable for its absence from audio literature and a person originating a piece of equipment is as likely as not to refer to a piece of overseas equipment or a circuit to jog his memory.

Unless he is aware of the distinction between an amplifier and a tape recorder there is an even chance that he will come up with the wrong answer.

Again, he may get a wrong answer from the literature. To quote an example, it is necessary only to refer to the Dick Smith catalogue section in our last issue. On page 37a is a diagram acknowledged to "Electronics Today." Without any endorsement it gives what seemingly purports to be standard connections to a 5-pin DIN socket. For a tape recorder they would be right; for an amplifier they would be wrong.

Red faces all round!

It would be possible to write off all such confusion as the natural and only-to-be-expected result of a non-thorough approach. But, even if one tries to dig a bit deeper, the picture still remains pretty murky. Let me quote from an explanation, taken originally from a European source:

"When a connector performs an output function, eg when mounted on a tuner, preamp mixer, etc; it uses pins 2, 3 and 5 (stereo) or 2 and 3 (mono). When the connector performs an input function, as when on a main amplifier, it uses pins 1, 2 and 4 (stereo) and 1 and 2 (mono)."

How do you interpret this? Is the plug on the end of a cord from a microphone, or a radio tuner, to be regarded as performing "an output function" from the source, or "an input function" to the device?

It may seem obvious to the writer or supporter of the scheme, but it certainly isn't obvious to the reader.

And how do you classify the connectors in Fig 1, which combine both functions? Is a tape recorder so obviously a "an output device," and an amplifier "an input device"?

As I write this, I am looking at a recent amplifier circuit from the Philips organisation in which a microphone socket is wired with input to pins 1 and 4 — which is at variance with the simplistic diagram of Fig 1. Yet the tuner input goes to a similar socket, to pins 3 and 5.

Undoubtedly, there would be some "logical" justification for this but it would probably be logic of the roundabout variety. And I would expect that a little more digging would turn up other seeming contradictions.

Verification of the difficulties comes from an item by Harry Leeming in "Hi-Fi News and Record Review" (Dec 71). It reads:

DIN CONNECTIONS

Unfortunately many manufacturers seem unable to read, and to prove this at first showed complete disregard for the "DIN" standards when fitting Continental-type sockets to their equipment. The message now seems to have got around and hence most modern equipment will be found to be wired to the following standards: —

AMPLIFIER	TAPE RECORDER
LH input pin 3	LH input pin 1
RH input pin 5	RH input pin 4
LH output pin 1	LH output pin 3
RH output pin 4	RH output pin 5

Note that these connections make it necessary to use a straight-through lead (ie

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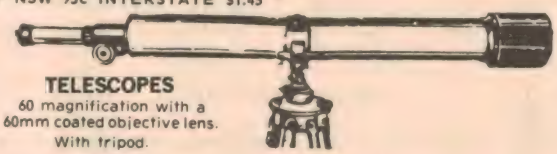

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Pin 1 wired to Pin 1) to interchange signals between a correctly wired amplifier and tape recorder. Connecting two tape recorders to each other involves the use of a lead in which the connections are crossed over, so that, for instance, Pin 1 on one plug is wired to Pin 3 on the other.

Harry Leeming disposes of the matter in quite summary fashion — including what seems to lie at the heart of the whole problem.

Was there ever any real objection to effecting a cross-over in connecting cables, so that pins 1 and 4 normally connected to pins 3 and 5, and vice versa?

In this way, pins 3 and 5, for example, could always be for signal input at the point of access to any device, while pins 1 and 4 could always be signal output at the point of egress.

It would certainly minimise confusion, and I can't see any great penalty from having to wire cables in accordance with such a practice.

After all, catalogues show literally dozens of pre-fabricated cables from various sources, with DIN plugs of one kind or another on one end or both ends, clips, pins-jacks, phone jacks, shielded and unshielded, in-built resistive pads and so on.

Who are we fooling?

"Electronics Australia" will probably have to observe the now established convention as closely as possible, but I have a feeling that one of our staff members has the laugh on us, privately.

He has disc equipment, tape equipment, a couple of sound film projectors, an amateur transmitting station and a reasonable array of test gear, all wired with 5-pin DIN plugs and sockets.

And they're all wired in the same way, with one pair of pins always used for input and the other pair for output. Maybe it's not "standard" but I'm willing to bet that his equipment can be interchanged more readily and with fewer cables and adaptors than would be necessary otherwise.

What have we overlooked? What is the real justification for the present DIN convention? Is it the result of a careful bit of original planning, or is it a hotchpotch, stemming from the concept of straight-through cables and an effort to preserve some sort of compatibility between the 3-pin and 5-pin connectors?

Another reference from "Hi-Fi News and Record Review" would seemingly lend weight to this observation: "The connections are simply reversed in order to provide a means of connecting items of equipment with a straightforward lead whose plugs are joined on a pin-to-pin basis."

Again: "Since they started life as 3-pin devices, their numbering sequence has pins 4 and 5 added as an afterthought."

We'd be interested to hear your reactions.

To get right away from DIN plugs, here's a letter from a Victorian reader, in reference to our "Serviceman" feature:

Dear Sir,

I have just finished reading "The Serviceman" (usually the first article I read each month) and I find that I cannot remain silent any longer.

Commonly, we find "Serviceman" referring to equipment as "a certain brand" or "from a well-known local manufacturer."

I am a radar technician and, although I could fight my way around a TV set, I prefer not to take my job home with me, relying more on purchasing equipment that I know to be of a reasonable standard. But "Serviceman's" remarks might just as well be in a foreign language as far as I am concerned.

The Government's attitudes to imports of goods competing with locally produced items more or less forces the less affluent to buy, in the main, the quick-buck-while-the-tariff-lasts Australian-made articles. May I hasten to add, that I am not condemning all Australian equipment, but something must be done to make the recalcitrant manufacturer "pull up his socks or get out."

This can be done in some small measure by EA if the brand / model giving these recurring faults is named. If the facts quoted are correct and substantiated there can be no fear of litigation.

(D.G., Ferntree Gully.)

Whew! To begin with, it might be wise to dissociate ourselves from the broadside aimed at Australian-made products. To be sure, some are poor, but the same could be said about imported items.

What the broadside does highlight is a (perhaps the) vital reason for D.G's reaction. He would like to know what equipment suffers from recurrent faults so that he can avoid it. And one of the reasons why we keep brand names out of the columns is to avoid just this reaction!

Basically, the Serviceman columns focus on faults and situations which give him the opportunity of discussing basic and (hopefully) interesting theory. Presumably he has succeeded as far as D.G. is concerned, because it is professedly the first section he reads.

But the actual number of cases involved is no more than two or three per month out of a total, for the average serviceman, of several per day. For every set that gets a mention, there are probably thirty or forty others that don't and that is just the point.

Let's say that the serviceman spends, typically, two columns discussing a fault in a television receiver, identified as brand A. There may well be a subtle influence on readers to avoid brand A, in case something similar should happen to them.

What of the other thirty or forty sets that didn't get a mention? Maybe there were ten each of brands B, C and D, all requiring service for faults that were routine and not particularly newsworthy — but faults, nevertheless.

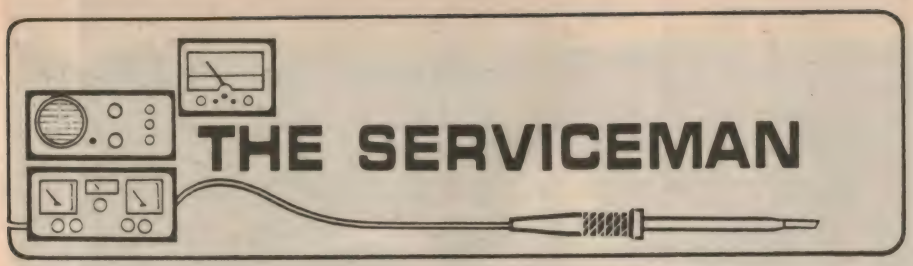
Statistically, brand A might be the best of the bunch and yet it gets the worst of the deal.

If one wants to reach conclusions about the reliability of brands and models, it is essential to seek information from sources which involve a sufficiently large number and variety of units and, even then, to remain alert for factors which could falsify the evidence.

Pressed for an opinion, a serviceman might admit that brand A gives them a lot of trouble; brands B and C are pretty good; brand D, they don't see many of them.

This could mean that you should choose either brand B or C, D being a not very popular make. Or it might mean that he doesn't come across many D's because they are reliable in the field.

Again, brand A may give the serviceman "a lot of trouble" because of poor accessability or other such factor. In terms of actual breakdowns, it might even be better than the others. Or the new model A, about which the serviceman knows little, might be a bottler!



What was that about starter cables?

I have a rather mixed bag this month. A reader takes me to task over something I said over two years ago; a set that was dropped causes some temporary confusion; and a couple of colleagues' stories have their lighter side — in retrospect.

The reader who takes me to task — rather belatedly, I feel — is concerned over some remarks I made back in October, 1970.

To put readers in the picture, those remarks were prompted by a garbled story in a local boating magazine, concerning care and maintenance of lead-acid batteries. More particularly, it was the following statement:

"Just as important are the cables. These must be of the right thickness. If too heavy a gauge is used . . . there will be greater than normal drain on the battery to supply the correct power to the starter unit."

My comment said, in part, that we could use a cable six inches thick — if we could pay for it and accommodate it — without any detrimental effect and, in fact, some very slight advantage. The main objection to such an arrangement would be essentially practical and economic.

Now the reader, Mr A.F. of Pennant Hills, NSW, says:

". . . various writers in your magazine . . . seem a little unmeticulous about Ohm's law. Take the statement by your serviceman — October 1970, p90, that we could use any size battery cable we like. Perhaps if he worked out a few precise figures he might be surprised.

"The six inch cable he suggests would double the initial starting current — would the brushes, starter motor and starter switch handle this without trouble? I don't know — but more important would your readers take his advice and use a very short and heavy cable, and end up in the blue water somewhere with faulty brushes and no starter power?

"Personally, I would accept the advice of the boating magazine, in spite of the rather quaint wording used."

Well now, let's take a closer look at these statements. I grant that A.F. has a point, in a general kind of way; namely, that there is little point in increasing the initial starting current above that necessary to do the job if, by so doing, we risk damaging the equipment. Unfortunately, I don't think his argument establishes that such a risk exists.

For example, he states that use of my fictitious six inch cable would "double the starter current." Note that there is no qualification, but simply a bald use of the word "double." Which, since precision is the term he is trying to emphasise, I can only take to mean "exactly double."

I wonder on what he bases that statement? I wonder what "precise figures" he used to reach that conclusion?

But even if we offer the benefit of the doubt and substitute, say, "substantially increase" for "double", the remainder of the criticism is still not very convincing. Since Mr A.F. has not offered any figures to support his contention, he puts me at something of a disadvantage. All I can do is produce some figures of my own.

These figures will be aimed at establishing that a major factor limiting the initial current in a starter circuit is the internal resistance of the battery. If this is high relative to the resistance of a typical cable, then reducing the cable resistance would have little effect on the total current.

Unfortunately, internal battery resistance is not a constant value. It varies over quite a wide range, depending on battery temperature and age, condition of charge, time since charge, rate of discharge, etc.

The best reference I could find was in a reprint of technical articles originally published in "Exide News." This contained a quite detailed discussion on the subject, together with typical figures used to illustrate the effect of varying each parameter.

In fairness, I picked the lowest figure I could find. This was .0015 ohm / cell, or .009 ohm for a typical six cell (12V) battery.

By comparison, the resistance of a typical cable is quite low. Starter cables vary considerably in diameter but, again in fairness, I have selected about the smallest size I have seen used in this role; approximately ¼in diameter or, at least, this effective diameter.

The closest to this in the wire tables is 3 SWG. This has a diameter of .252in and a resistance of 0.1605 ohm / 1000ft, or .00016 ohm / ft. If we allow a length of 3ft for the starter cable (a fairly generous figure) we get a resistance of .00048 ohm.

In round figures, this is 1 / 20 the internal resistance of the battery. In these circumstances, the cable resistance would have so little effect on the total current that, even if it were completely eliminated, the current would increase by only 5pc approximately.

And this argument takes no account of the resistance within the starter motor itself; mainly that of the armature windings and the brushes. This will be quite low — I am unable to quote an exact figure — but, whatever it is, it can only aid the above argument, because it makes the cable resistance just that much less important again.

So there it is. On the basis of these figures there would seem to be little need for anyone to worry about using too large a cable.

From my service bench this month I have a short story which bears some resemblance to one which I related a few months back (August 1973). This was about a portable set to which I fitted a mains power supply, and the puzzling situation where the set would work on the power supply and not the batteries.

As on that occasion, it was an elaborate portable, purchased overseas, and I imagine quite expensive, even in that market.

The owner's explanation of the fault was simple. "One of the kids dropped it and it won't go."

Well, that was to the point, at least. I felt sorry for the poor kid though; I'll bet he copped it.

Strangely enough, the set didn't seem to have suffered much obvious damage. A knob had been broken off a lever switch, but otherwise everything seemed to be intact. And my experience is that most sets will take a pretty hard knock without suffering any serious damage. Most will continue to play after a bash that will crack the case.

I opened the case and looked inside. Once again there was little evidence of damage. The main casualty appeared to be the aforementioned lever switch, which turned out to be an AM / FM switch, the set boasting an FM band. Apparently, the set had landed face down on this knob, breaking the knob and bending the lever and associated mechanism.

More importantly, it had jammed the mechanism with the moving contacts midway between the two sets of active contacts. As a result, neither the AM nor FM circuits were engaged.

Even so, the switch did not seem to be badly damaged and I indulged in a little judicious prodding with the blade of a screwdriver. This worked, at least to the extent that I was able to push the moving contacts over into the AM position.

Feeling very pleased with myself, I switched on, fully expecting the set to work. It was a bit of a let down when it didn't.

I went over the set again, looking for further evidence of damage, but found nothing. The most likely explanation, I reasoned, was a subtle crack in the printed wiring. And, since the set was completely dead, I further reasoned that this was most likely in the main battery supply line, close to where the battery lead joined the board.

First I checked the battery, measuring across the contacts in the battery compartment. On no load the voltage was somewhat less than the nominal 9 volts, but hardly enough to cause suspicion. But when I switched the set on, the voltage dropped to zero; a most unusual way for even a sick battery to behave.

Nevertheless, I pulled all the cells out, intending to check each one, or fit a completely new set. In fact, I didn't have to. The cause of the bother was now plain to see; corrosion of the battery contacts.

It took only a few minutes to clean the contacts, replace the cells, and switch on. Hey presto! Beautiful music!

While gratified to have the thing working, I was temporarily puzzled. How come the set had two faults, one of which had nothing to do with it being dropped? And which had happened first, the drop or the corrosion?

The most likely explanation seemed to be

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that the accident had occurred several months ago and that the set had been in working order at that time. Apparently the owner had simply put it to one side, too disgusted or too afraid to make any enquiries about repairs.

But corrosion had already begun. The owner lived in a beachside suburb and a few grains of sand which I had found inside the set confirmed that it probably made regular trips to the beach.

Thus, by the time it arrived in my workshop the second fault was well and truly developed; a nice little trap which I walked right into. And, as with the case in the August issue, the situation was further confused by the use of the VTVM. A less sensitive meter would have sensed the corrosion immediately.

Incidentally, battery terminal corrosion appears to be a significant problem with portable sets, particularly those using simple pressure contacts. Even without the goo from run down batteries, there seems to be enough natural corrosion to cause trouble eventually. And if the set is taken to the beach regularly, or is even housed in a beachside suburb, the process is much accelerated. Strictly speaking, I suppose, such contacts should be cleaned every time a new battery is fitted, but I doubt whether many people would be bothered, even if they thought about it.

My next story was related to me by a colleague. It concerned a Japanese eight track cassette car player, virtually new, of which the owner complained that the volume and balance controls were faulty. Unfortunately, the unit and the complaint were delivered by a third party, who was unable to add anything to the basic complaint.

The unit is built in a metal case, with a plastic dress plate on the front panel. This, in turn, carries an anodised aluminium label identifying the controls. I imagine that the one plastic dress plate serves for a number of models, an appropriate aluminium label being fitted as required. The controls are operated by "thumb wheel" type knobs.

My colleague passed the job over to his workshop assistant, together with the customer's complaint and a suggestion that the two pots be checked. By reason of its construction, it is necessary to remove the dress plate in order to replace any of the pots. Anticipating that he would have to replace both pots, the first thing the assistant did was to remove the dress plate.

That done, he proceeded to check the pots. Strangely, he could find nothing wrong with them. Both the volume and balance functions were quiet, smooth, and easy to operate. The same applied to the tone control, which he checked as a matter of course.

Unable to find anything wrong, the assistant called my colleague into the workshop and demonstrated the unit's performance. My colleague was as puzzled as the assistant; shrugging his shoulders, he simply instructed that the unit be put back together and held until the customer called for it. Hopefully, the customer could demonstrate the fault that was worrying him.

So the assistant replaced the plastic dress plate, confirmed that the unit was still working, and passed it back to my colleague for a final approval. It so happened that this could not be done immediately, but when my colleague did get around to it, he quickly realised that there really was something wrong with the controls. More precisely, the volume control was functioning more like a balance control, and the balance control would have made a good volume control.

The assistant, when called, was similarly puzzled for a few minutes, before the penny dropped. "That label's wrong!" he explained. My colleague was dubious. While there was no doubt that the positions of the two controls were transposed, relative to the label, he was more inclined to the theory that the two controls had been wrongly fitted.

But the assistant was adamant. And to prove it he produced another model of the same set which was also in for service, and the workshop manual containing a photograph of the finished unit. Sure enough, both showed the volume and balance positions transposed relative to this unit.

It was clear now what had happened. Apparently the makers had another model in the system somewhere which used this transposed aluminium label. Somehow, during production, one (or more?) of these labels had been mixed up with the regular ones. Nor is it hard to imagine such a subtle mistake getting through the inspection system, particularly in view of the language difference.

Not until the purchaser actually started to use it did anyone realise that anything was wrong. And even then it was not obvious, to him, that it was a simple matter of transposed labels. All he knew was that neither the volume control nor the balance control behaved as he thought they should.

But how much more satisfactory would it have been, all round, if the owner had been able to demonstrate the fault directly to my colleague. Much time would have been saved, and the risk of an unsatisfactory transaction avoided.

The problem was solved, incidentally, by purchasing a new plastic dress plate from the agents. Whether the owner ever realised that only the label had been changed is not known, but apparently he was quite happy with the result.

To finish off, here is a short, humorous story which a colleague recently told me against himself. The truth is, he has been carrying this guilty secret around on his conscience for over 15 years now, and I suspect it was a relief to finally confess.

As this implies, it was in the early days of TV. My colleague had taken delivery of a new model TV set, ordered by a customer. Without bothering to remove it from the carton, he loaded it on the truck and drove to the customer's home.

Having unpacked it, located it where the customer requested, and plugged it in, there came the big moment; switch it on and demonstrate this latest wonder of the age. The only snag was, he couldn't find out how to switch it on. He fiddled with the volume control in the usual way but, while the volume action appeared to be normal, the switch action just wasn't there.

In desperation he opened the set and traced the mains cable. Sure enough, the switch was on the back of the volume control, but no switch action could he find. Forced to the conclusion that the switch was faulty, he temporarily bridged the switch connections in order not to disappoint the

Continued on Page 125

The complete range of Optoelectronic devices

Photodiodes

OKI photodiodes are of diffused planar silicon construction, feature high performance and reliability and are suitable for application in computer peripheral equipment, process control, industrial control, photo-meters or any other design requiring light sensitivity.

A 9-bit silicon photodiode array is available which finds application in punched paper tape readers of input machines for computer and NC equipment.

Phototransistors

OKI phototransistors are of planar silicon construction and are highly sensitive devices. They are particularly suitable for use in optical measuring equipment, control devices and other electronic applications.

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OKI numeric displays are of GaAsP monolithic or hybrid, 7-segment composition. They are suitable for application in a wide variety of display apparatus. Features include high brightness with small current, numerals 0-9 and decimal point and rugged, vibration-resistant construction.

Typical applications include computer terminals, electronic desk and portable calculators, cameras, electronic wrist watches and various digital measuring instruments.

The alphanumeric display (not illustrated) is a 5 x 7 dot matrix of 36 GaAsP red L.E.D.s.

Light Emitting Diodes

OKI L.E.D.s are available in INFRARED, RED or GREEN versions. A wide range of body styles is available to suit a multitude of applications including solid-state indicators and displays, photo-choppers, photocouplers, photo-switches . . . e.g. punch tape readers, conveyor control, rotation counters, automatic weighing machines, position control and opto-isolators.

Photocouplers

The OKI photocoupler employs GaAs L.E.D.s and Si photo-transistors. Its light source and sensor are optically coupled with no electrical connection. Typical applications include pulse transformers, photoswitches, photorelays, power separation circuits (for analog and digital) and level converting circuits (for potential and impedance).

***Optical Mark Sensor**

(*not illustrated)

OKI manufacture an optical mark sensor which senses by the reflection method, 12-unit signal marks and a timing mark recorded on the paper for OCR use and converts the data into electrical signals.

It is composed of GaAsP L.E.D.s as the light source, planar silicon photodiodes as the sensor and IC preamplifier.

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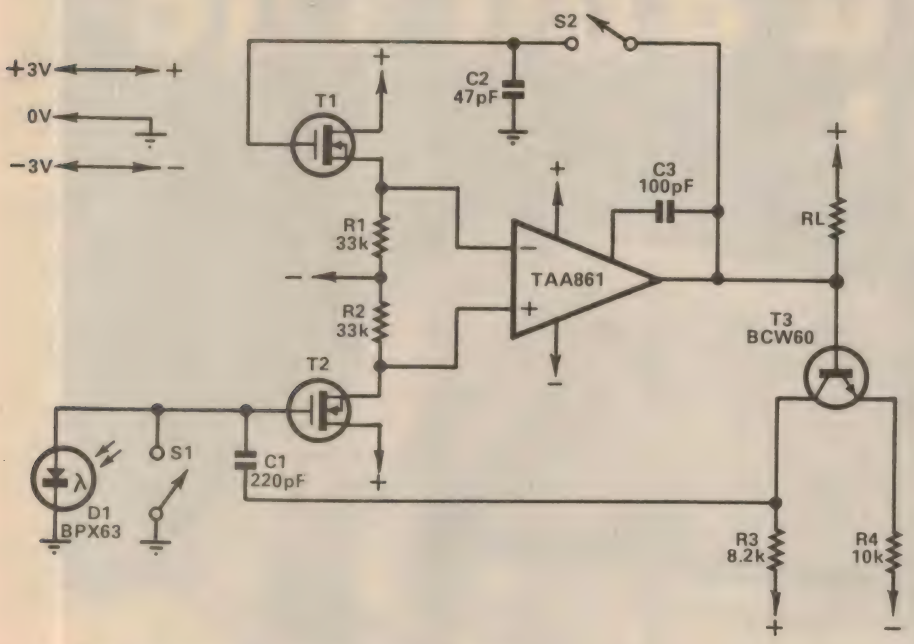
AC79

CIRCUIT & DESIGN IDEAS

Interesting circuit ideas and design notes selected by the Editor from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome.

Photodiode BPX63 — All It Needs Is Starlight



Even the light of the stars on a moonless night is sufficient for the new Siemens photodiode BPX 63 to operate as an optoelectronic receiver. A circuit for a photographic exposure meter designed in the Siemens Applications Laboratories ensures that the aperture setting can only be affected by the useful signals and not by noise.

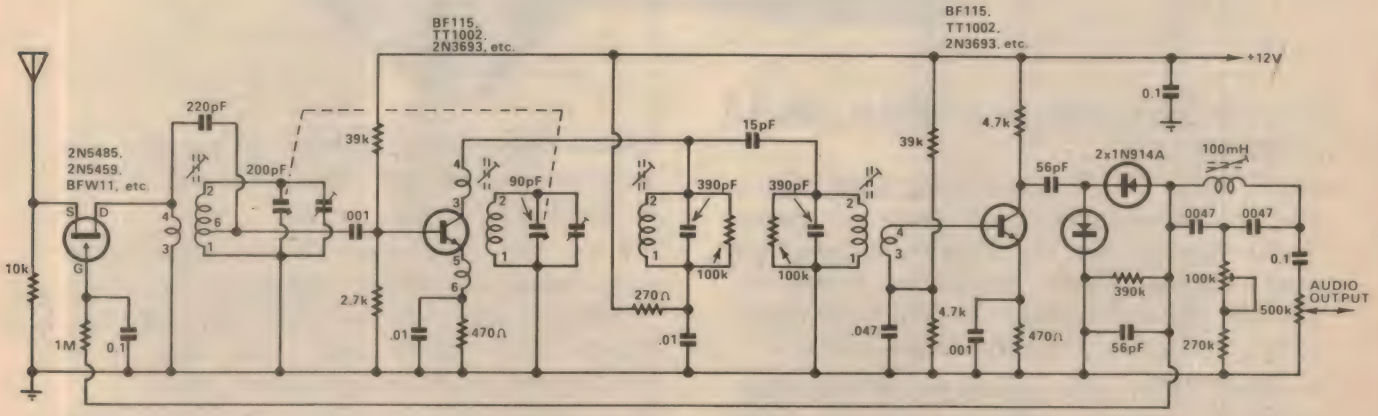
The photodiode consists of a phosphorus-doped n-type substrate, in which there is a thin p-conducting region formed by implanted boron ions. The photodiode exhibits an adequate blue response. Following diffusion, any crystal defects are eliminated by means of several tempering processes, so that the noise current is kept at a low level. The working part of the diode occupies an area of 1mm square. If required, diodes with larger areas displaying the same characteristics can also be manufactured. The diode chip is alloyed to a TO-18 base plate and coated with a transparent plastic drop.

When the device is used in a photographic exposure meter, maximum exposure times of 20 seconds at 10^{+2}lx are obtained. The switches S1 and S2 are closed when the camera shutter is not open. The output of the operational amplifier is therefore connected with its inverting input via transistor T1. The transfer factor between the control electrode of each field effect transistor and the output of the amplifier is one, so that drift and offset voltages reach the output unamplified and may therefore be neglected as sources of error.

At the start of exposure, the switches S1 and S2 are open. The amplification is now more than 3000. The integrating capacitor C1 is charged by the photocurrent, causing the output voltage to increase linearly with time. The transistor T3 initially operates as a phase inverter, until its base-emitter junction begins to conduct at an output of 1V. Exposure is completed when the capacitor C1 provides feedback via transistor T3, so that no current is flowing through the load RL.

(For further information contact Siemens Industries Limited, Melbourne, Sydney, Brisbane, Perth, Newcastle and Wollongong.)

A Simple Wide-Band Tuner



This little tuner is a spin-off from development work I have being-doing on a new Homodyne tuner. Stripped of an IC and sundry other bits and pieces, we still have a tuner in its own right, simply by taking the audio from the voltage doubler diode rectifier used for the AGC system.

The circuit is a very simple superhet, with one tuned circuit at signal frequency, ahead of a self-oscillating mixer. This is followed by an over-coupled pair of IF transformers. There is one stage of IF amplification before the diode detector. Audio recovered from the detector is fed via a 10kHz whistle filter to a 500k preset level control.

The DC negative voltage developed across the detector load is used to control a junction FET between the aerial input and the primary winding of the aerial coil. The source and drain of the FET are maintained at zero DC potential but at the same time, the same two elements are kept at a medium impedance level for signals, by the 10k resistor in the source and the coil

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primary winding in the drain circuit. An RC filter consisting of a 1M resistor and a 0.1uF capacitor feeds into the gate of the FET. The varying negative DC potential with signal level at the gate has the effect of causing a varying resistance in series with the aerial circuit, so controlling the effective signal input to the first stage.

The overall bandwidth of the tuner is such that the recovered audio is down only from 3-6dB at 10kHz. This means that at night, 10kHz heterodyne whistles would be intolerable without the 10kHz whistle filter. The filter gives a deep notch at this frequency but has virtually no other effect on the overall frequency response. The sensitivity of the tuner is of the order of 400uV, which means that it is for local reception only, the best aerial being found by experiment.

Aerial, oscillator and IF coils are types S203, S201 and ST45C, or 7155, 7348 and 9185, made by Aegis and Transcap, respectively. A whistle filter is made by RCS Radio and which uses the circuit values as shown, or a transcap coil may be used, in which case the .0047uF capacitors should be replaced with .047uF and the 100k trimpot and 270k resistor replaced with 1k each.

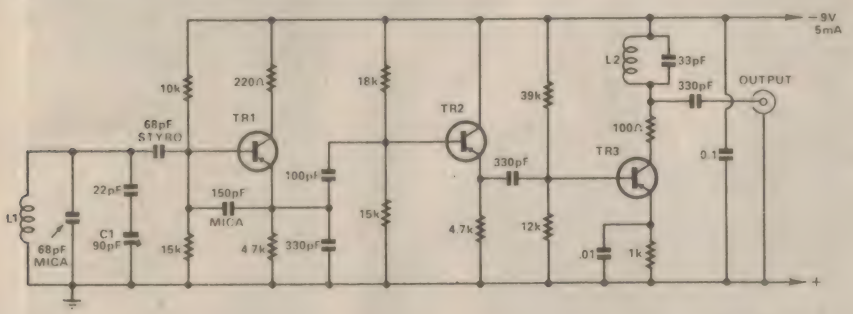
If you wish to save a little, you may wind your own IF coils. It is important to change the two 390pF capacitors with 330pF when using the home wound coils. The coils are wound on Neosid type E adjustable inductance assemblies. The tuned winding consists of 130 turns of 36B&S enamel copper wire and the second unit requires a second winding consisting of 15 turns of the same wire.

I used two sections of a Roblan padderless gang. Layout should be done according to normal principles, with a logical sequence and short leads. An ideal approach would be to use the printed board, 73/12T designed for the bigger tuner which we hope to describe very soon. Just ignore the places for the IC, etc.

Alignment follows the normal procedure for superhets but an additional point must be observed when aligning the two IF coils. Shunt one tuned winding with a 4.7k resistor while the other one is adjusted, and vice versa. Do not forget to remove the resistor when alignment is finished. The 100k shunting resistors must be left in circuit. A power supply capable of delivering about 35mA at 12 volts is required.

By Ian Pogson, Electronics Australia.

Solid State 1.8MHz VFO



This transistorised VFO provides 7mA of drive to my 6CH6 PA in the 160 metre AM transmitter which I have had in service for some time now. I also have one driving my 6BM8 160 metre transmitter. In this unit there is a mixture of OC44s and OC45s. It would also make a fine VFO for VHF use.

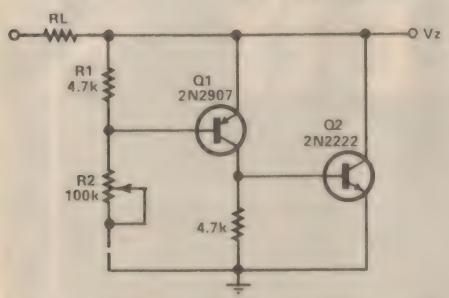
I have tried transistor types AF115, AF116, AF117 and AF118 in each of the stages of the VFO. By reversing the battery polarity, I found that types BC108, BF115 and BF184 all worked OK. The 90pF variable capacitor is one section of a small broadcast gang. I have not tried transistor radio style aerial or oscillator coils but these should be worth trying. Use silver mica capacitors where specified to keep frequency drift to a minimum.

While testing the VFO it must always be loaded, otherwise the output stage will take off. The frequency drift was only 5Hz over one hour, measured on an "Advance" counter.

(By John O'Connor, VK5JQ, in "MRC News".)

Editorial note: No details are given for the oscillator coil but we imagine that readers will have their own ideas. As always, a high grade coil should be used, one which is both mechanically and electrically stable. One of the best materials for this application is ceramic, with the coil wound tightly.

Design Your Own Variable-Voltage Zener



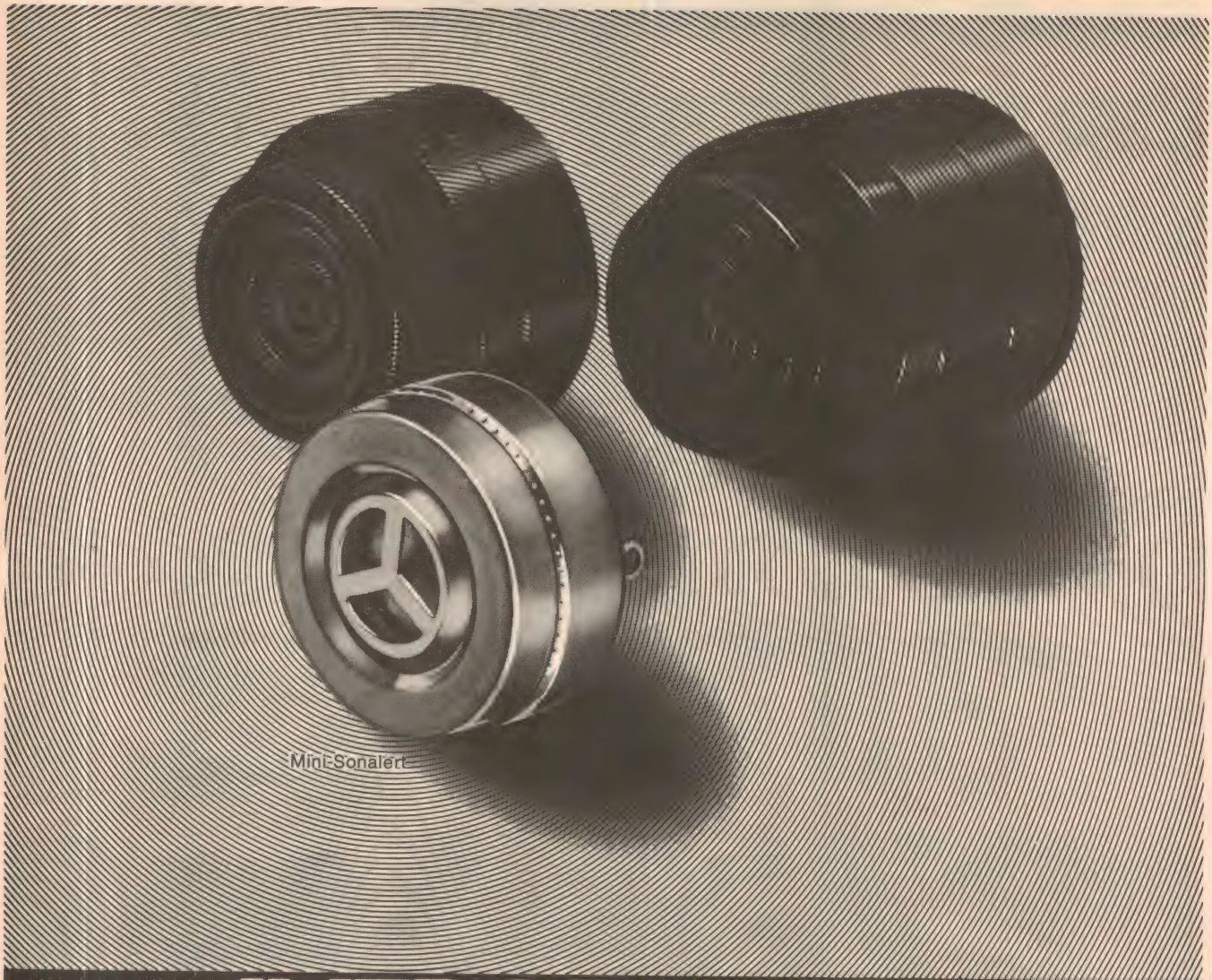
Zener diodes are useful circuit elements but unfortunately, they are available only in discrete, fixed values of voltage. In some cases, a variable voltage is needed, and a zener will not suffice. In addition, zeners are not commonly availably at levels below about 3 volts. This makes it difficult to design simple 1.5V regulators for battery replacement.

With only a handful of components, a transistor equivalent of a zener diode can be built for use in any circuit calling for a zener. The output voltage from the "equivalent zener" is variable and can be adjusted to values down to as low as about 1 volt.

The circuit is quite simple. It is what amounts to an "upside down" emitter-follower, using a complementary Darlington pair. The output voltage will be determined by the setting of R2 and the current flowing through Q2 will adjust automatically, giving the requisite voltage drop across RL.

Transistor Q1 can be almost any silicon PNP transistor, but one with a high current gain is preferable. The parameters of Q2 are not critical either. The power dissipating capability of the equivalent zener is primarily determined by the power dissipation rating of Q2, so it should be selected accordingly. The equivalent zener diode can be used in any circuit where a regular zener would apply.

Resistor R2 is shown as variable but fixed values of resistance may be used if desired. Assuming that R1 is 4.7k, the equation, Vz equals R1 plus R2, divided by twice R1, gives the zener voltage for the chosen value of R2. Since the voltage does depend to some extent on the characteristics of the transistors, the calculated value of R2 may not give the exact desired voltage but it will be close. (By James E. McAlister, "in Popular Electronics".)



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Literature is available on request to the Professional Components Division.

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AC 81

Colour Television Systems

Nature of light. The colour spectrum. Spectral and non-spectral colours. Methods of colour reproduction; printing, photography etc. The three colour concept. Colour primaries. Subtractive and additive mixing. Methods of additive mixing. Application to TV. Summary of terms.

Having studied the previous chapter on monochrome TV the reader should now be in a good position to learn something about the next logical development: colour TV. A good place to start such a discussion is with a study of light itself, with particular emphasis on the phenomenon we call colour.

It can be assumed that most readers are already familiar with the nature of light rays.

In brief light rays are electromagnetic radiations having an extremely short wavelength — between the limits of 400 and 800 millimicrons.

Light rays themselves are pure electromagnetic radiations, and are not in any sense. "coloured." However, when the rays penetrate the normal eye mechanism, they do stimulate sensations, depending on their wavelength, which the observer describes as colour.

Thus, radiations of the longer wavelengths produce the sensation of red, which passes gradually, with reducing wavelength, through to orange — yellow — green — blue — violet. This range of hues, together with those intermediate between them, constitute what are known as the "spectral" colours.

Combinations of red from one end of the spectrum with blue-violet from the other end, produce the non-spectral colours from deep red, through magenta, purple and violet to deep blue.

So-called "white" light contains rays of all wavelength, while "black" indicates the absence of visible rays.

Any colour which can be plotted as a sharply defined curve of response against wavelength is said to be approaching "saturation." — or purity of spectral response.

Colours may be "diluted" with white rays to produce pastel shades, while low-light intensities or pigments darkened with black produce brown, olive green, navy blue, etc.

These are general statements and cover all aspects of colour reproduction, ranging from the artist with his palette and the printer with his inks, to the photographer, the projectionist and the television engineer.

Each one has his problems of technique, but the ultimate objective is the same — to present to the eye something which it sees as an acceptable colour reproduction.

An ordinary outdoor scene may well contain an almost infinite variety of colour values ranging from deep violet right through the visible spectrum, to deep red. Some of the hues may be readily defined as well-known colours, others a complex mixture of two or more such colours.

When such a scene is to be reproduced by artificial means — by artist, photographer or television engineer — the difficulty immediately arises of reproducing the full range of colour values without employing a prohibitive range of pigments, dyes, filters or coloured phosphors — whatever the medium happens to be.

Many factors arise, in practice, to complicate the choice and the mixing of basic colours but, by and large, the more such colours available to the operator for mixing, the more closely will the reproduction follow the original.

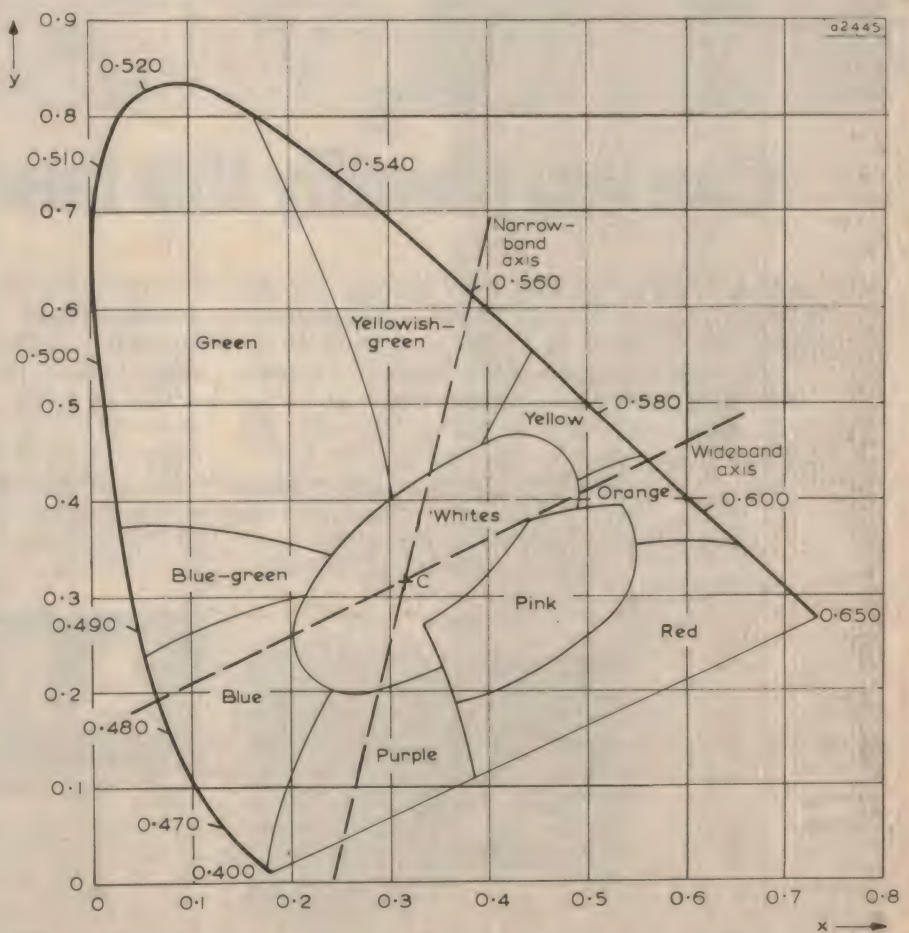
At the same time, on a commercial basis, each new constituent colour means an extra operation and adds to the cost, so that some deliberate compromise is necessary.

The simplest form of colour reproduction uses only two basic colours, generally a green-blue and an orange-red.

A two-colour print in a magazine thus involves only two printing plates, two shades of ink and a press which prints one colour over the other.

By way of further example, the two colour process was once used for motion pictures. The first "Technicolour" process employed only two colours, and there were many processes prior to this, most of which resorted to the simple trick of coating the film with emulsion on both sides.

One emulsion recorded the colour distribution in the orange-red end of the spectrum, the other the colour distribution



This horseshoe shaped chromaticity diagram is now regarded as a standard way to present the colour spectrum. Saturated spectral colours are shown along the horseshoe outline, commencing with red at bottom right, through green at the apex, to blue at bottom left. Non-spectral colours (purples etc) are shown along the bottom line. White is shown at "C", with progressively dilute colours between the outline and "C". An example is red which progresses through various shades of pink towards white.

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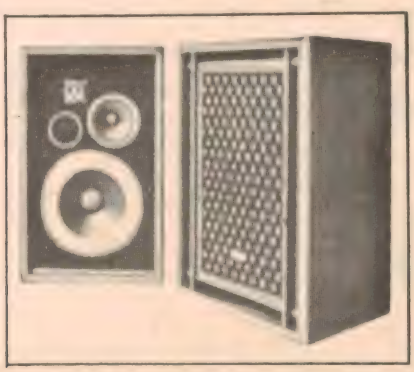

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AK 49P

at the green-blue end.

After a suitable developing and dyeing process, the two images in combination gave an approximate colour transparency.

The range of tones which can be simulated with only two constituent colours is very limited and the results, for general use, are poor. True reds and yellows are missing, being interpreted as varying shades of orange. Greens and blues likewise tend to merge into varying densities of the one green-blue base colour, omitting the deep, saturated hues.

Nevertheless, many feature films were made using such processes. By careful choice of colour for scenery, costumes, props etc, and careful attention to makeup, the end result was at least acceptable. The price was a severe restriction on what could be presented, particularly in regard to outdoor scenes. Later, these systems were restricted to advertising films and were finally discarded completely.

By using three basic colours it is possible to obtain a range of colour values which is generally accepted as adequate for commercial presentation.

The three-colour system is justified further in principle by the yet unproven theory that the eye itself has three groups of retinal receptors which are respectively sensitive to radiations at either end and the centre of the visible spectrum.

By using three similar colour sources for the reproduction of a scene, it would seemingly be possible to approximate the eye's range of colour vision.

Without debating this idea further, it is sufficient to say that the three-colour system of analysis and reproduction has been adopted as standard for colour photography, colour moving pictures — and for television. Colour printing has its own special facilities and problems.

Having established that much, it then becomes necessary to decide just which three colours — generally referred to as "primaries" — are most suitable. This is where considerable confusion can arise in the mind of the reader, particularly if he considers the various colour reproduction systems at a superficial level, rather than in depth.

To avoid such confusion it is advisable to look upon any colour reproduction process as involving two distinct sub-proceses: (1) analysis of the colours in the original scene and (2) reconstruction of the colours in the final presentation.

As far as (1) — analysis of the original colours is concerned — there is little real disagreement; in general terms they are red, green, and blue. More specifically, there is an international standard as follows:

700 millimicrons — red, but with a slight yellowish tinge.

546.1 millimicrons — green, also with a slight yellowish tinge.

435.8 millimicrons — blue, with a slight reddish tinge.

Note, however, that slightly modified values may be selected for some processes to compensate for inherent limitations.

Standardised filters are available which show maximum transmission at these wavelengths or exhibit, for alternative methods of analysis, a maximum degree of opacity. It is thus possible to speak, for example of a "red" filter or a "minus red" filter.

Whatever the system involved, however — photochemical or photo-electronic — the filters are always arranged to analyse and record from the original scene the overall distribution of the three basic colours, loosely referred to as red, green and blue.

In regard to (2) — reconstruction of the colour image — these same colours MAY, or MAY NOT, be used, depending on the method of colour mixing.

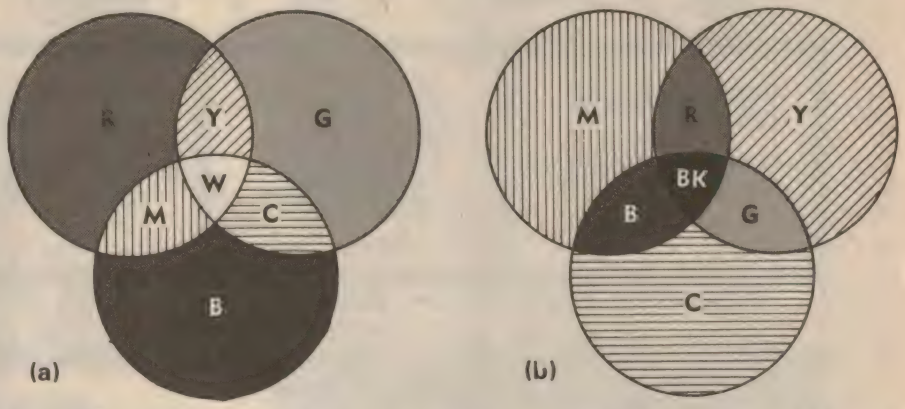


Fig 1. At (a) is illustrated the fundamental additive primaries and the colours which result from their additive mixing. At (b) is shown the subtractive primaries and the results of their various conbinations. Note that all three additive filters produce white; all three subtractive filters produce balck.

Colours may be mixed in two ways: (a) by a process of summing colour stimuli in the eye, or (b) light subtraction and mixing in the reproduction itself.

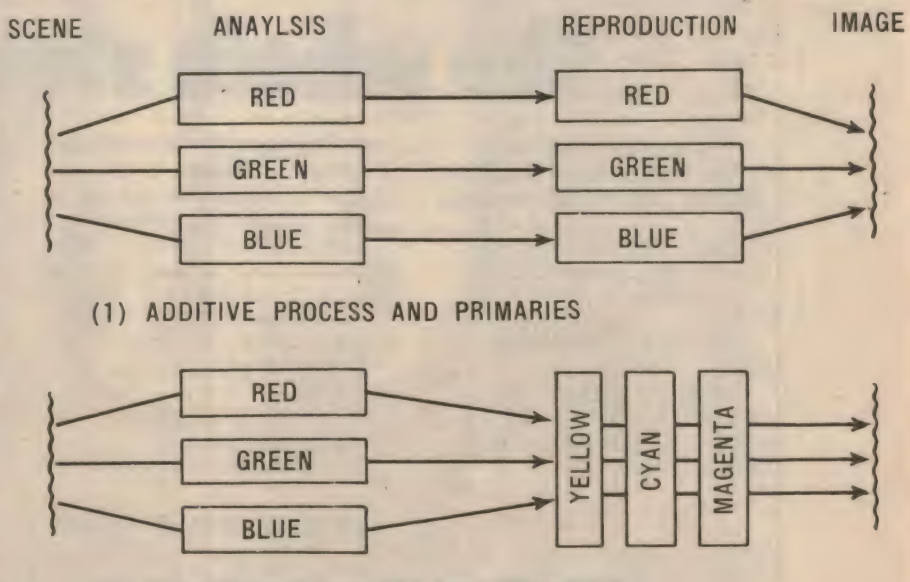
In simpler language (a) is known as the "additive mixing" system and (b) as the "subtractive mixing" system. It is most important that the reader fully understand, and be able to distinguish between the two systems.

Let us consider a typical example of both systems, taking the additive system first. We start with a white reflecting surface, initially in total darkness, and three projectors, each arranged to project a circle of light on the screen. Each projector is fitted with one of the three primary filters already described; red, green and blue, and the three projectors are aligned so as to produce a pattern of three overlapping circles as in Fig 1 (a).

Fairly obviously, where there is no overlap the original colour from each projector will be observed. But where any two colours overlap, a third colour will be produced; red and green overlapping gives yellow, red and blue gives magenta, blue and green gives cyan. And where all three overlap, we get white.

The subtractive system is illustrated in Fig 1.(b). Here we start with a source of white light, say a lamp behind a frosted screen, and place three filters in front of it, again overlapping. A major difference is the colour of the filters. Instead of red, blue and green, we now have cyan, yellow and magenta. But just to keep things in their right perspective, we should point out that cyan might be more correctly referred to as "minus red," yellow as "minus blue" and magenta as "minus green."

Again, where there is no overlap the original colour of the filter is observed and



Additive and subtractive methods of analysis and reproduction. Note that the same primaries, red, green and blue, are used for analysis in both cases, and for reproduction in the additive system. Magenta, yellow and cyan are used for reproduction in the subtractive system.

Mr. Sato hasn't told you the whole story.

Mr Sato would have had to buy half of this magazine to show you every part he makes and we stock.

Ten pages would be needed for pilot light assemblies alone.

Three pages for neon lamp holders.

Eight pages for terminal blocks.

One page each for fuse holders, snap switches, key switches, see-saw switches and push-on switches.

Three pages for other switches.

Three for sockets.

Two for plugs and sockets.

One each for connectors, feeder plugs and sockets, square-type connectors, and square type plugs and sockets.

Two pages would be needed for metal plugs and sockets.

One for binding posts and terminals.

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where two filters overlap, a third colour is produced; magenta and yellow overlapping gives red, magenta and cyan gives violet, cyan and yellow gives green. And where all three filters overlap we have black.

These two examples have been deliberately chosen because they are simple and clear cut. In practice either system may be exploited by a variety of methods, such that the particular system being employed may not be immediately apparent.

But try to keep the salient points of the two systems in mind: In the additive system we start with black (no light) and add colours until we eventually produce white. In the subtractive system we start with white and progressively subtract colours until we eventually produce black.

By and large, our traditional conception of colour values and resultants, based on painting and coloured prints, stems from the subtractive principle, and it is interesting to examine this more closely.

An ordinary coloured picture, as in a magazine, is illuminated by light falling on its surface. For proper viewing, the light should be "white," containing components of all wavelengths and therefore of all colours.

The section of the pictures corresponding to the sky would use an ink or a pigment which absorbs most of the red-orange-green rays falling upon it. Rays near near the blue end of the spectrum would be reflected back to the eye, however, and the particular section of the picture would appear blue as a result.

Similarly, the pigment depicting red objects would absorb all rays but the red, these being reflected back to the eye.

For green objects — grass, trees, etc — it has long been established that the desired stimulus can be obtained by mixing together yellow and blue in the desired proportions. The blue absorbs all the red-orange-yellow rays, while the yellow absorbs all the vlue-violet. The only rays which are reflected are equivalent to green and this is the final colour stimulus received by the eye.

Used alone, the yellow reflects yellow rays while, in combination with red, the whole range of orange tones is available.

In turn, the red combined with blue covers the whole range of non-spectral colours from deep red and purple to violet and deep blue.

Use of all three colours together give brown, olive green and navy blue. Also, in carefully controlled proportions, a wide range of almost pure greys can be obtained, through to an almost pure black.

It is thus obvious why artists, through the centuries, have come to regard red, yellow and blue as primary colours.

The fact that they were relying on a subtractive process and that another system of mixing was possible, was largely unknown. Also, and more importantly, they did nor appreciate that the "red" they used was (or should have been) more correctly magenta, and the "blue" was more corectly cyan.

The optimum primary colours for subtractive mixing may be determined mathematically with the same precision as for additive primaries and, in fact, have been standardised on a world-wide basis in the same way.

While these statements are mathematically accurate, their practical application is complicated by the fact that commercial inks and pigments are seldom pure, exhibiting marked irregularities in their response curves. This leads to secondary colour reactions on mixing, so that unexpected hues are likely to result.

In an effort to cancel such unwanted effects, or to emphasise a particular hue, or even simplify a process the artist or colour printer may easily select other than the optimum subtractive primary colours for his essentially subtractive reproduction.

What with this and loose terminology, it is easy to see how the fundamental physical primaries — red, green and blue — appear to conflict with the conventional subtractive primaries of magenta, yellow and cyan. Get the terms right and half the trouble immediately disappears!

Though the main reference has thus far been to coloured prints and pictures, the "subtractive" principle is also used to produce photographic transparencies, such as Kodachrome. In this case, layers of sensitive emulsion, which are subsequently dyed, subtract the unwanted rays from the white light and transmit the remaining rays to produce the colour sensation.

Because Kodachrome, and other transparencies use the subtractive principle, they must of necessity use the same three primaries in the ultimate reproduction as for colour printing. The exact hues may, of course, be modified somewhat by commercial difficulties.

If the reader traces through the Kodachrome principle, for example, it will be found that the red of the original scene is recorded by a red-sensitive emulsion. After development it is presented to the eye as an equivalent red by subtractive combination of magenta and yellow dyes.

The same is true in sequence for the original green and the original blue in the scene.

In other words, even though the final transparency is prepared with magenta, yellow and cyan dyes, their subtractive combinations and the original analysis of the scene revert to the essential physical primaries of red, green and blue.

The significant point about subtractive mixing is that the eye receives only one band of frequencies from any given area on the picture surface. The merging of the colour stimuli may, therefore, be said to occur external to the eye.

By contrast, additive mixing occurs when the eye receives stimuli of two or more distinct colours from sources which exist separately but which cannot be individually resolved.

By way of example, (1) The colours may be projected simultaneously from different sources onto (or through) a common screen. The separate colour stimuli are presented to the eye but mixed therein to produce some predominant colour sensation.

Then again (2) the colours may be flashed on to the screen alternatively but in such rapid succession that they are merged by the eye, due to persistence of vision.

Finally (3), the colours may be presented as a mosaic of tiny lines or dots which are too small to be resolved individually. They merge instead into a coherent additive colour pattern.

One of the earliest demonstrations of simultaneous additive colour reproduction was demonstrated by Maxwell in England, in 1861.

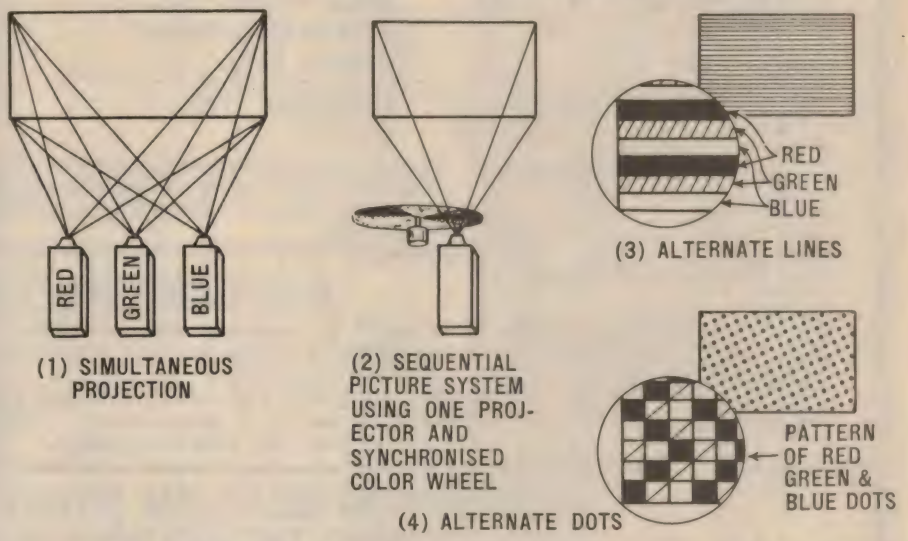
In that year, Maxwell photographed a scene through blue, green and red filters to produce three separate black and white negatives. These were duly printed on to glass slides and projected in register on to a common screen by three separate projectors, each one through an appropriate coloured ilter.

The nett result was an acceptable three-colour image.

The principle of simultaneous screen projection has been applied many times and in many ways since Maxwell's original demonstration and is a perfectly legitimate method of colour reproduction. Its obvious disadvantage is that it requires three separate films and projectors and the images must be kept in very accurate register.

These considerations virtually prohibit its

ADDITIVE COLOUR SYSTEMS



Four basic methods of additive colour mixing; simultaneous projection, sequential projection, alternate lines and alternate dots. Only the simultaneous projection and alternate dot methods have survived as practical television systems.

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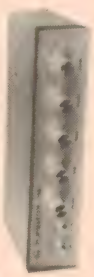

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use photographically, particularly for motion-picture work.

On the other hand, these limitations are much less serious when applied to television and it has become an accepted method of large screen television display.

The second method of additive colour mixing relies on the persistence of vision.

The classic lecture-room experiment to demonstrate the phenomenon is to fit radial red and green sectors of glass or cellophane to the shaft of an electric fan.

With the sectors moving slowly, both colours are clearly visible. Switch the current on, however, and the two colours appear to merge into a yellow tone.

Equivalent results are obtained from varying combinations of all three primaries, as outlined for simultaneous projection.

This so-called colour sequential method of presentation means, in practice, that complete red, green and blue versions of a scene are presented to the eye in rapid succession.

In television, the images may be made up from monochrome images projected through a rapidly rotating and carefully synchronised colour wheel. Thus, the version of the scene, originally obtained through a red filter, is projected as a red image because the red segment of the wheel tints the light at the appropriate instant.

Similarly for the green and blue versions.

If the rate of presentation is sufficiently rapid, the eye not only fails to perceive the separate images but it successfully merges the primary colour images to produce a complete range of secondary colour combinations.

Ideally, the rate of presentation should be such that there are from 40 to 60 complete presentations of each colour per second, even though this may mean from 120 to 180 pictures per second, all told.

The important point is that, if the repetition rate of each separate colour is not kept high, pronounced flicker will be apparent in areas which are illumined by a single bright primary colour.

Difficulty also arises from fast-moving objects which are of such a nature that they involve illumination by any two or all three of the primary colours. They tend to break up into separately coloured "ghost" images.

The third system of additive presentation involves breaking the scene into tiny segments or lines which are too small or too fine to be resolved individually from the normal viewing distance.

The segments or lines are arranged in ordered sequence and the light reflected or transmiitted by them varies according to the content of the image.

Thus, in areas demanding a relatively pure red hue, only the red segments or lines would reflect or transmit light. The other segments would be opaque.

Magenta and purple shades would require transmission by both red and blue segments, yellow would require red and green, while white would require transmission by all three basic colours.

One of the best examples of this form of additive colour is the now-defunct Dufay system of colour photography. Close examination of a Dufay picture will reveal a three-colour segment pattern and, under a microscope or with sufficient enlargement, the three primary colours may readily be observed.

A modern example of additive colour mixing using simultaneous projection; the Qantas 747B flight simulator. Picture shows the aircraft flight deck with a screen in front of it and the red,green and blue high intensity TV projectors on the platform above it. Images representing the airport and surroundings add realism to the flight crew's training.

At the normal viewing distance, however, the eye fails to resolve the pattern and the whole merges into a coherent image with the full anticipated range of primary and secondary colours.

Of all the systems, the segment or "dot sequential" system holds the advantage as far as television is concerned, for two reasons:

(1) Colour TV signals can be transmitted in such a way that they can be received as normal black-and-white pictures on ordinary receivers. This is of enormous economic advantage.

(2) Dot sequential pictures are less prone to flicker effects and to colour break-up on fast-moving objects.

While these three systems differ superficially, it is important to remember that they are all additive systems. In fact, the additive system is the only one which appears at this stage to be practical.

To employ a subtractive system it would appear necessary to mount between a light source and the eye a series of filters whose destiny could be varied instantaneously and electronically. No simple method of achieving this result appears to be available, although tentative suggestions have been made.

We will have more to say about practical systems in the next chapter. In the meantime, the following summary of pertinent colour facts and terminology should be kept in mind.

Brightness: Brightness is simply the intensity of the light, as described by the subjective terms, "bright", "dim" etc.

Hue: Similar to colour, in that a blue object has a blue hue However, hue takes no account of saturation, which may alter the colour, but not the hue.

Saturation: The purity of the colour; the absence of white which would dilute it. A saturated red might be described as a "brilliant red"; the same red diluted with white might be described as a "pale red" or "pink".

The additive primaries, as used for all forms of colour analysis, for some early forms of photographic reproduction, and for all forms of television reproduction are:

Red, green and blue.

The subtractive primaries, used for reproduction (only) of colour printing processes, colour films (Kodachrome etc) are: Magenta, yellow and cyan.

In the additive process the presence of all three colours produces white. In the subtractive process the presence of all three filters produces black.

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INTERDYN

Let's talk about crystal sets (Part 2)

Elementary Electronics

by Ross Tester

Last month we introduced you to the basic crystal set — and how it worked. We promised some new crystal sets based on the original ideas, but with novel changes. Here they are.

First, let us briefly recap on what we said last month: A basic radio receiver consists of an aerial (and earth) to receive the signals; a tuned circuit to separate the wanted signals from all the other signals in the radio spectrum; a detector to extract the audible signal from the radio signal, and an earphone — to convert the audio signal into sound.

The aerial, detector and earpiece were discussed last month. There is not much (at least in this type of receiver) which one can do to improve them. However, the tuned circuit can take a variety of forms — and it is this with which we are concerned this month.

Last month's basic crystal set was tuned by varying the capacitance. Our first set this month uses the same method, but the other uses variable inductance. We will explain more about this later.

Our first set is similar in some respects to last month's design, but has one vital difference: instead of a single tuned circuit we now have two; two coils and two tuning capacitors.

Why two tuned circuits? A serious limitation with any crystal set is its poor selectivity. The reason is simple; a single tuned circuit just cannot provide sufficient discrimination between the wanted and unwanted signals. This is aggravated by the fact that the single tuned circuit will be loaded by both the aerial and detector circuits connected to it. (More about "loading" in a moment.)

It is for this reason that larger sets use several tuned circuits (plus other tricks) in order to achieve adequate selectivity. If the output of one tuned circuit can be fed into a second one, resonating at the same frequency, the rejection will be greatly improved.

It is a similar process to purifying a liquid. The first process gets rid of most of the impurities, but some are able to sneak through. The second process is able to get rid of most of those missed by the first, but there will still be some which manage to find their way through. This process could go on and on, but there are limitations. At each purifying (as at each tuned circuit) some of the wanted material is lost. Therefore, there is a limit to the number of stages one can have.

Unfortunately, feeding the output of one tuned circuit directly into a second one is the least desirable procedure. If these two circuits are too intimately coupled they cease to function as separate circuits, and behave more like a single circuit. On the other hand, if they are not adequately coupled, there will be a serious loss of signal.

Front panel of the Deluxe Crystal Set. Note the simple hand span dial with the station markings behind it. The panel was made from stiff card, using Letraset rub-on letters.

This problem is overcome in larger sets by interposing amplifying stages between the tuned circuits, which also effectively isolate them. Since we have no such stages, we must select a compromise order of coupling.

When a tuned circuit is at resonance, the wanted frequency builds up voltage and current to a maximum, while the signals of other stations are largely rejected. Because the voltage and current are changing, a changing electro-magnetic field is set up around the coil.

If a conductor is placed in a magnetic field, a current is set up in the conductor. If we place another coil so that it is in the magnetic field, it will have a current set up in it. This is a transformer action — it is the same effect which allows a transformer to step voltage or current up or down from another voltage or current. (Remember our articles on power supplies?)

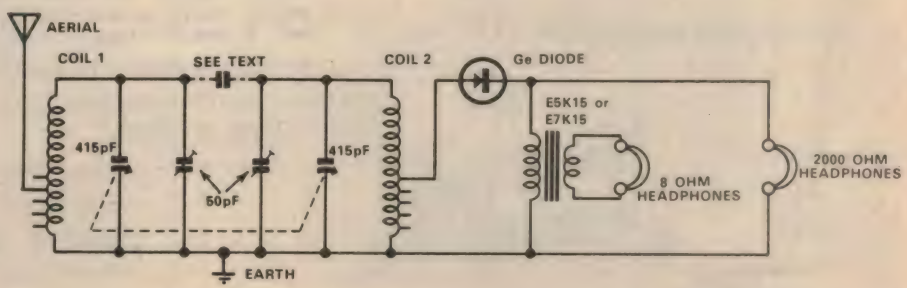
Maximum transfer from one coil to the other occurs when the coils are oriented in the same direction (either end to end or alongside one another) and are close together. But, as we have seen, it is not always desirable to have maximum coupling between the coils.

For this reason we have made the coupling variable, by arranging one coil so that it can slide along a slot cut in the baseboard. This is quite a simple method of altering coupling.

The situation may arise that, no matter how close the coils are placed, there is still not enough coupling for reasonable listening. In this case, a small amount of capacitive coupling may be added by connecting a 4.7pF capacitor between the tuned circuits. (See circuit) Note that 4.7pF will be about the maximum value — it will probably not require this much.

The coupling is not the only item which needs adjustment. Note the trimmers on top of the tuning capacitor. These are used to adjust the individual tuned circuits so that they both resonate at the same frequency for a given dial setting. Adjustment should be made at the high frequency end of the band (2SM, 3AK, etc).

We used two different types of trimmer, mainly to show what to look for on discarded sets. The first is a compression type, adjusted with a screwdriver, while the



Circuit of the Deluxe Crystal Set, showing the two tuned circuits. The capacitor (dotted) between them may be needed only in some circumstances. The trimmer capacitors are used to "line up" the two circuits at the high frequency end of the band.

other is a concentric type, screwed in by hand. Any other type may be used. Simply solder them between the fixed plates of the capacitor and the frame.

As in last month's crystal set, a high impedance to low impedance speaker transformer is included. This time we used an E7K15, but an E5K15 would be equally suitable. Most old valve radios with have a speaker transformer with an impedance of 5000 ohms or more — these are quite suitable.

Earlier in this discussion we used the term "loading" in regard to the tuned circuits. The selectivity of a tuned circuit is effected quite markedly by the external circuits we connect to it; such as the detector and earphones, and the aerial. The more intimately these are coupled to the tuned circuits the more they load it, and the worse the selectivity.

This is the reason for the taps on the coil; they allow us to select the best order of coupling. The tap giving the smallest number of turns produces the lightest loading and the best sleectivity, but gives the weakest signal. Then conversely, the tap with the largest number of turns gives the strongest signal, but the worst selectivity.

In any given situation the best tap will depend on such factors as the size of the aerial, strength of the signals, number of stations available, etc. Thus the user has to make his own selection, possibly even changing them to receive different stations.

Construction of the set is not too involved — anyone with basic woodworking tools could manage it. In fact, some may like to treat our construction as a starting point, and enclose the crystal set in a wooden case.

We used a plywood base board, measuring 200 x 140mm, with a Masonite front panel measuring 200 x 120mm. The front panel is glued and nailed to the baseboard. Placement of components is not critical, as long as you place both coils in a straight line. The slot for the moving coil is 115mm long, and starts 10mm from the side of the baseboard, 30mm from the back.

Lightly centre punch marks along the slot line every 5mm, and drill them with a ⅛in drill. Then elongate each hole so that it meets its neighbour. Finish the slot with a rat tail file.

Both the moving and stationary coil are secured with ⅛in Whit screws and nuts. (The amount of metal is too small to have any serious adverse effect.)

When mounting the moving coil leave enough wire to allow it to travel the full length of the slot. Similarly for the lead from the taps.

Longer nuts and screws are needed for the moving coil, as this has two nuts on each screws. Watch that the shaft of the tuning the heads from coming through the slot, washers must be placed on each screw before insertion. We used washers between the nuts and cardboard former, to prevent undue stress on the cardboard.

Because the screwheads protrude below the bottom of the baseboard, rubber feet are screwed to the four corners to provide clearance.

Other components (gang, transformer) are mounted with no. 4 or 6 self-tapping screws. Watch that the shaft of the tuning capacitor emerges in the middle of the front panel — it would be wise to mark this first. The transformer mounts between the moving coil and the headphone sockets.

A 3 lug tagstrip (1-E-1) is mounted underneath the right hand side screw holding the gang. On this is mounted the detector diode.

On the front panel, two terminals (red & black) provide aerial and earth connections, with two sockets (one stereo, one mono) for high and low impedance phones. The dial is a push on "handspan" dial suitable for ¼in shafts. As many older tuning capacitors have ⅜in shafts, an adaptor may be necessary. These should be available from your supplier, along with the handspan dial. If your supplier has difficulty with the dial, he should be able to obtain them from Watkin Wynne Pty Ltd, who are the wholesalers. Note that you must obtain one through your normal supplier.

The high impedance socket is optional. Its place may be taken by a tagstrip, if you are sure you will not be using high impedance 'phones. The impedance transformer connects between the high impedance socket or tag (primary winding — red and blue) and the low impedance socket (secondary winding — green and black).

The front panel is made from a piece of thin cardboard, lettered with "Letraset". The cardboard was stuck to the Masonite with "Aquadhere" wood glue.

Lettering of the stations is best left until the set is complete. When the wiring is completed, check for errors. If you are sure there are none, connect the aerial and detector leads into the highest tap on the coil. This should ensure that at least something will be able to brute-force its way through.

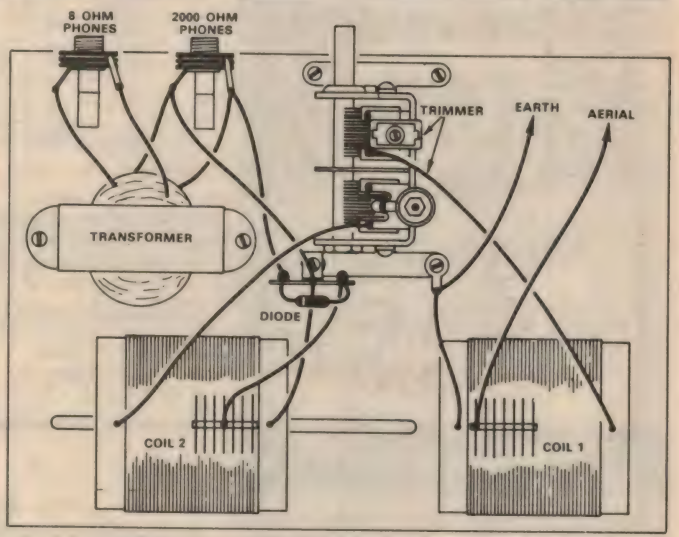
If stations are well separated, leave the taps where they are. But we imagine there will be little or no selectivity on this high tap. Even moving the coils wide apart may not help much. Move the aerial and detector taps to about half way down, and check. Keep moving down until you are able to separate each station well. Then tune to a high frequency station (2SM in Sydney, 3AK Melbourne, etc) and adjust both trimmers for maximum volume. Once the trimmers are peaked, try moving the coil back and forth.

Incidentally, the only way to make sure alignment is correct at the low frequency end (2FC or 3AR) is to ensure that the coils are identical. It is difficult to provide adjustment on either coil to correct this. So take care when winding the coils.

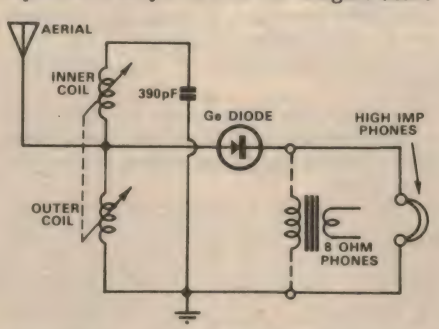
As you learn to use the crystal set, you should find the right combination of taps and coupling give optimum results from all your favourite stations.

The next set is quite novel — believe it or not, it is built in a matchbox!

It contains just two commercial components — a diode and a small fixed capacitor. The other two major components are a pair of homemade coils. One coil is mounted inside the matchbox tray and the other is wound over the outer portion of the box. To tune it, all you do is try to get a match out of the box — in other words, move the tray. This tunes in the stations!



The layout of the Deluxe Crystal Set is not critical, but that shown here is a logical one. The coil on the left is the movable one, sliding in the slot shown. Refer to the front panel on the previous page for terminal and jack positions.



The circuit of the Matchbox Crystal Set. Tuning is achieved by varying the coupling between the two coils.

Why build a crystal set in a matchbox? Well, why not? Apart from its novelty and simplicity, this little crystal set is capable of a good performance. Connected to a good aerial and earth, it will perform just as well as the "straight" crystal set described last month, and nearly as good as the deluxe model just described.

The operation of this set is based on the fact that the inductance of one coil can be changed by another coil in close proximity. Because the coils are simply connected in series, it might appear that the resonant frequency of the tuned circuit would be governed only by the capacitance across the coils.

This is only part of the story. Because the coils can be moved relative to one another, we have a situation where the inductance of one coil can "buck" or oppose the inductance of the other coil. By the same token, the opposite is true. By physically turning one coil through 180 degrees, the inductances can be made to assist, or add to one another. In practice, more range is obtained by opposition than addition.

By planning the size of the coils, and the amount of fixed capacitance across them, we can make them cover the broadcast band. The natural resonant frequency of the inside coil will be around 750Hz — roughly corresponding to 2BL in Sydney and 3LO in Melbourne. By placing the outer coil on one way, down to 530kHz is covered. Turning this coil around will cover the other end of the band — up to 1600kHz.

As with all other crystal sets described, this may be operated with 2000 ohm phones, or 8 ohm phones through a speaker transformer.

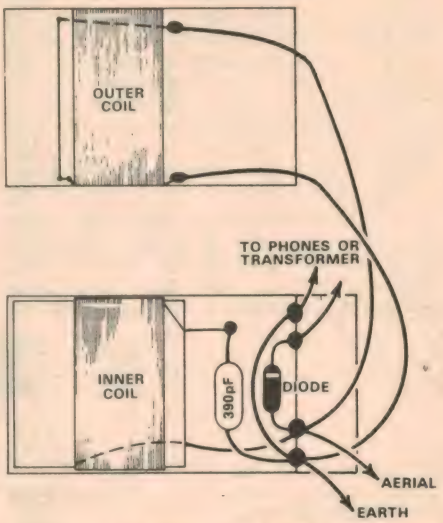
Construction of the matchbox crystal set could hardly be simpler. No woodwork, very little soldering and few components. You will need an ordinary matchbox (try to get one as new and strong as possible) some thin cardboard, some good paper or cardboard glue, a germanium diode, a 390pf polyester, mica or ceramic capacitor and around ten metres of 30 B&S insulated copper wire.

The first step is to construct the cardboard former for the inner coil. Using the pattern given as a template, cut a thin cardboard piece the same size, and bend where shown. Glue this and leave to set. While it is setting, you can wind the outer coil on the matchbox cover.

Where shown, drill two holes 3mm apart. Scrape the enamel off 50mm of wire and pass the end of this wire through the hole closest to the centre of the box. Pass it back out the other hole, and continue to loop it in this fashion four or five times. This will securely anchor the wire. Cut of any excess wire.

Now wind on the turns. These should be as tight and neat as possible. They should not be able to move when the job is completed. Wind on 39 turns and, when these are completed, drill another two holes similar to the first pair, as close to the last turn as possible.

With a hot, clean iron, place a blob of solder over each of the loops. You will use these as anchorage points later.



Layout of the Matchbox Crystal Set. Aerial, earth and phone connections are mounted on the end of the matchbox tray.

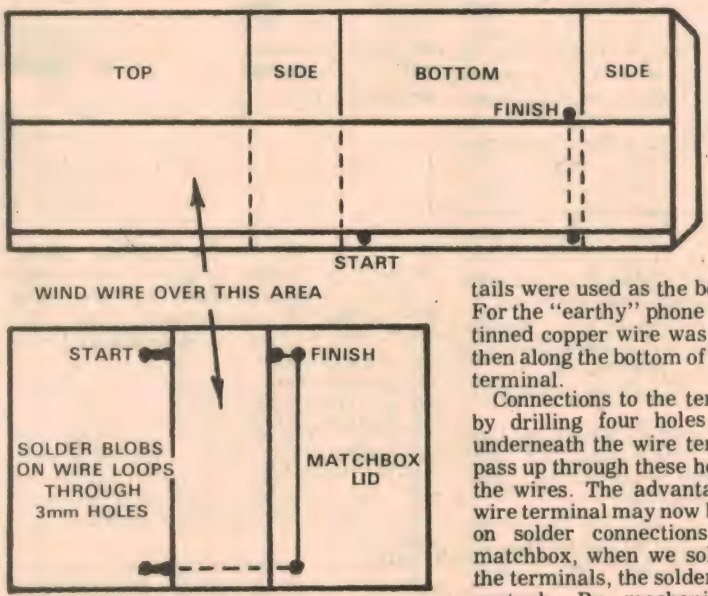
Before glueing the former into the tray, you must perform minor surgery. If you look closely at a matchbox tray, you will see the end is made by folding the two sideflaps in and the bottom up and over these sideflaps. The bottom flap must be unfolded — this is used to pull the tray in and out — while the side flaps must remain in position as the anchorage points for all connecting leads.

Because unfolding the bottom flap reduces the strength, it is a good idea to give all flaps a liberal coating of glue before going any further. At the same time, another piece of cardboard, the same size as the extended flap, can be glued over this to give added strength.

Now the former can be glued in place. A glue such as "Tarzan's Grip" is very good for this purpose. The former is glued as close as possible to the end of the tray opposite to the end we have been working on. When the glue is dry, you can prepare the components for soldering.

We have evolved a rather novel way to make connections and hold the components in place. In the end of the tray, we made four small holes. As you can see from the drawing, these are for the aerial, earth, and earphone connections. Through the "earth" hole, we passed one end of the capacitor lead, bent it 90 degrees vertically, then bent it again 180 degrees over the top of the tray and back down the inside. This was then squeezed hard with a pair of pliers to hold it in place.

The other three terminals were treated similarly. Where possible, component pigtails were used as the bend-over terminals. For the "earthy" phone terminal, a piece of tinned copper wire was bent over the flap, then along the bottom of the box to the earth terminal.



The upper drawing is an exact size template for the coil former to mount in the tray. Lower drawing shows lid holes and winding.

Cut the wire 50mm from the hole, and scrape the enamel off this. Loop through the holes in the same way as before, and cut off any excess.

The inner coil is wound on the former which we described earlier, the former then being glued inside the tray. The coil is wound in much the same manner as the outer one. The ends are terminated in a similar way, by passing them through pairs of holes several times, but the wire is not trimmed close. Leave about 30mm of flying lead. This coil is slightly larger, requiring 48 turns.

Connections to the terminals were made by drilling four holes through the tray underneath the wire terminals. Thin leads pass up through these holes and solder onto the wires. The advantage of the crimped wire terminal may now be seen. If we relied on solder connections alone inside the matchbox, when we soldered the wires to the terminals, the solder inside might come unstuck. By mechanically holding the components in place, soldering can be carried on without this risk.

The outer coil is connected by means of flying leads to the aerial and earth terminals. These flying leads are cut from thin hookup wire (we used 5/0076), and soldered to the "solder blobs" on the matchbox lid.

You may note that after we soldered the leads to the outer coil, we wrapped a piece of insulation tape around the box. This is to prevent undue stress on the solder joints.

Using this set is child's play — simply move the inner tray in relation to the outer cover, and you should find station coming and going! As with the other sets, 2000 ohm phones may be used directly, or 8 ohm phones through a suitable transformer.

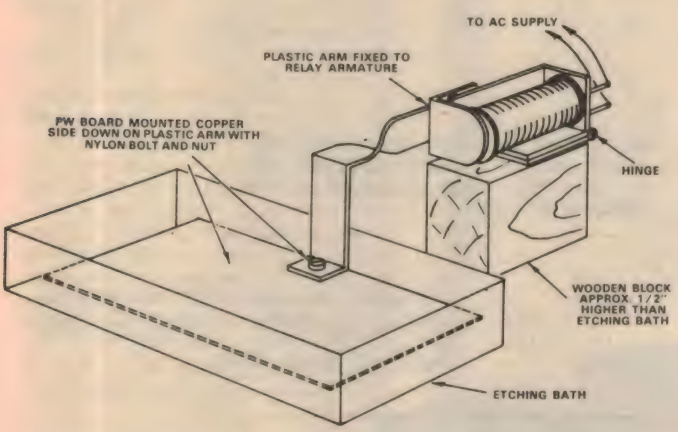
Elementary Electronics Ideas Worth Trying

Etchant Agitator

I have designed a device for improving the etching time for printed wiring boards. It consists of a relay, a hinge, a few pieces of wood, and a strip of plastic or Perspex.

The relay is turned on its side and mounted on a hinge supported by a block of wood about 15mm higher than the acid bath tray.

The strip of plastic is fastened to the relay armature and has one twist and two bends in it. The twist turns the strip from vertical to horizontal, the first bend takes it down into the acid bath, and the second bend creates a small lip to which the board may be attached.



In use, the hinge allows the relay assembly to be lifted while the tray is removed or replaced, or a board fitted or removed. The board is fastened to the plastic strip with nylon nuts and bolts, and should be copper side down.

The relay winding is fed with AC, causing the board to vibrate in the horizontal plane. This speeds up the etching process significantly.

(Mr N. Uncle, 85 Field Avenue, Edithvale, Victoria, 3196.)

Transistor Holders

As I am a student on a tight budget, I have to use parts several times over. Soldering and de-soldering these parts resulted in a lot of leads being broken until I came up with this solution. When making up a circuit, I use a lot of transistor holders (mine cost 25 cents each from Kitsets Aust.) I use these not only for transistors, but for diodes, LDRs, capacitors, etc. The result is a lot longer use from all components, particularly as I don't have to put any heat on them.

(Mr B. Green, Post Office, Donnybrook, WA 6239).

Is it a PNP or NPN Transistor?

How readily can you recognise the "polarity" of a transistor symbol? Take a quick look at the nearest symbol and ask yourself whether it is PNP or NPN. If you can't make an immediate decision, the following hints may help. One is from a reader, the others from our own staff.

(1) Remember that the arrow points in the direction of conventional current flow, ie, from positive to negative. Thus the arrow is always pointing towards the negative terminal. The same rule applies for diodes.

(2) The middle letter of the normal three letter designation indicates the polarity of the collector supply. Thus, a PNP transistor has a Negative collector supply and an NPN type a Positive collector supply.

(3) This is our reader contribution. He suggests that the combination PNP could stand for "Point into Plate", the "point" being the arrow on the emitter symbol and the "plate" being the base symbol. Obviously, the opposite arrow arrangement then indicates the opposite letter combination, NPN.

(Mr I. Langtree, Ensay, Victoria, 3895).

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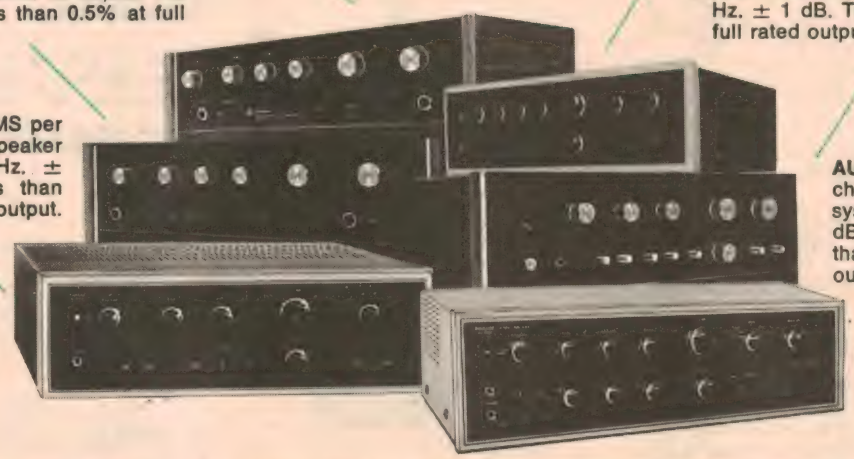

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CLASSICAL RECORDINGS

Reviewed by Paul Frolich

Schubert — Piano Sonatas, "Very private music"

SCHUBERT — Piano Sonatas No.2 in C major, D.279 and No.20 in A major, D.959. Wilhelm Kempff. D.G.G. stereo 2530 327.

There is no doubt that Schubert's piano sonatas are very private music, not heard at their best in concert halls and virtuoso recitals. Schubert at his most confidential is best played at home and if you cannot play it yourself, a gramophone recording will do fine. Kempff, at his most unassertive, mellow and friendly tries to prove the above and comes close to winning.

At this point, I must confess that I've never liked Kempff and his old-maidishness; however, he made these recordings about 1968 when he was at the top of his form and I don't find his personal manner quite as unpleasant here as I had firmly expected. His pedalling is not as clean as one might wish and there are moments, particularly in the second movement of the A major sonata when I'd give a lot for just a trace of a sense of drama — but, fair enough: this is Kempff's way and he is quite entitled to his view of Schubert.

There is, in fact, quite a lot to be pleased about. The mellow piano sound is ideally suited to Kempff's musings and the rather limited dynamic range he employs. The A major sonata is one of Schubert's greatest works, but it requires a little bite in the playing if its true greatness is to emerge. The early, and incomplete C major sonata (not, alas, available in any other recorded version) seems just a trifle pointless in the interpretation it is given here.

There is no doubt that this is a very agreeable disc and good Kempff; it is not, in my opinion, good Schubert. I would suggest waiting for the Brendel version, sure to arrive pretty soon (I expect it will be the exact opposite of this one: uncomfortably prickly, intellectual). Ideally, I'd like performances by either Tessa Birnie or Demus . . . for now, we'll have to make do with Kempff's undoubted, and minor, qualities.

★ ★ ★

BEETHOVEN — "Volkslied" Variationen. Eva Ander, piano; Johannes Walter, flute; Peter Glatte, violin; Jutta Zoff, harp. Festival (Eurodisc) stereo 80005 / 6.

This two-record set, issued in Australia by Festival, contains some of Beethoven's least known music; even if many will also regard it as Beethoven's least important music, I found these pieces sheer joy and find myself playing them over and over again.

Despite the title, this set contains more than the "folksong" Variations, in themselves almost unknown nowadays. Commissioned by the London publisher Birchall in 1816, the Variations of opus 105 and 107 were intended for domestic music-making of a type then very popular. Opus 105 consists of six Airs, each with from three to six variations, opus 107 of ten themes with from two to six variations each.

The thematic material chosen by Beethoven varies greatly in quality and provenience; most of the tunes are of either Irish or Scottish origin (all labelled as "Scottish" by the composer!), with a few Austrian and Russian ones added for good measure. They include the famous "Last Rose of Summer", very discreetly disguised by Beethoven, who seemed to have some doubts about its suitability and the wonderful air "The Highland Watch", which receives a suitably haunting treatment.

In accordance with the practice of the day, these pieces are written for piano with optional accompaniments by flute or violin; in this recording, the two optional instruments are used alternatingly and although they contribute little of importance, they sound suitable enough and add to the fun, generally — particularly since they are quite excellently played. Beethoven was the acknowledged master of the Variation form in his day and he certainly does every tune justice.

The composer's genius in this field is even better exemplified in the other pieces on these discs. The "6 Easy variations in F major for harp on a Swiss air" are utterly charming; the 7 Variations in C major on "God Save the King" (then regarded as a song rather than an anthem!) for piano solo are extremely advanced musically and always worth hearing. Finally, there are the lovely 12 Variations in F major on Mozart's "Se vuol ballare"; played by piano & violin, Beethoven's score performs the most gratifying wonders with this aria. An album to enjoy!

★ ★ ★

BARTOK — Violin Concerto No.2 (1938); Rhapsody No. 1. Henryk Szeryng, violin and Concertgebouw Orchestra, Amsterdam, conductor Bernard Haitink. Philips stereo 6500 021.

Although Bartok's 2nd violin concerto is now as familiar and as familiarly loved as are the concerti by Beethoven or Tchaikovsky, one must keep in mind how recent such acceptance really is. A mere 25 years ago, this work was virtually unknown to the average music lover and its first hearing was quite an adventure!

Many listeners still think of Bartok as abrasive and hard to understand; if you belong to that group, this disc may well be your cure. The violin concerto is not, of course, abrasive: on closer acquaintance one remains conscious mainly of its lyricism and almost romanticism. Earlier recordings of the work — notably by Menuhin and Gertler — differed in some respects. Menuhin, the first one to play it, first recorded it with Furtwangler and, later on, with Dorati. Both his interpretations emphasise the beauty of the music and its richness.

Gertler, on a Czech recording, gave a more aggressive interpretation and Hungarian music-lovers regard his version as idiomatically superior. I like all three of these performances, but am bound to say Szeryng's is better than any of them. There is just that little extra bite in his playing, a little more liveliness and a little more thought, perhaps. More importantly, the Concertgebouw gave the remarkable orchestral score more rewarding attention than I've heard previously.

The Rhapsody, one of two immediately accessible folksy works dating from 1920 fares equally well and is at least as successful as in Stern's 1963 version with Bernstein on CBS. Both works are greatly enhanced by Mr Haitink's enlightened reading of the sources and the exquisite recorded sound.

For Bartok lovers, this release is an occasion for rejoicing; for others, it is an opportunity to rid themselves of some of their prejudices and to approach the music of Bartok without fear.

★ ★ ★

SAINT-SAENS — Symphony No.3 Pierre Segon, organ; Orchestra of the Suisse Romande, conducted by Ansermet. Le Rouet d'Omphale, op.31. Paris Conservatoire Orchestra, conducted by Jeac Martinon. Decca stereo SPA 228.

Saint-Saens C minor symphony, for a large orchestra including organ and piano duet, has long been a favourite with many conductors and many of them, including Toscanini and Beecham, have made successful recordings of the work. Written in 1885, the piece is the major monument of French symphonic music of its period and it certainly deserves attention.

The Ansermet version of this grand work is not, I think, the best ever, but the performance, in general, is very adequate, allowing for the less than virtuoso standard of this popular Swiss orchestra. If you want to hear this work at its spectacularly best (though I don't know why you'd want to bother), I suggest the more recent Mehta recording.

With this minor reservation about the orchestral playing and some finer point of hi-fi, the present item is to be highly commended. Although the recording is now more than a decade old, it still sounds pretty exciting.

It may be safely assumed that Mr Segon is an excellent organist, as good in his field as was Ernest Ansermet at conducting. But whereas Ansermet could do no more than get the best out of a merely good orchestra, Segon has the privilege of displaying the organ's shattering pedal-stops with quite unprecedented 19th-century glory. As a recording of rich organ sound, this disc is unique and all organ buffs should acquire a copy — assuming that they have sound equipment equal to the occasion — a truly demanding one.

Omphale's Spinning Wheel is a perennial orchestral favourite and it is quite exceptionally well-played on this occasion, with equally felicitous sound. In all, this is the kind of bargain record that it is hardest to resist.

Julian Russell is currently overseas, and in his absence, Classical Recordings will be reviewed by Paul Frolich.

SCHUBERT — Duets. Janet Baker, contralto; Dietrich Fischer-Dieskau, baritone; Gerald Moore, piano; members of the RIAS Chamber Choir. DGG stereo 2530 328 (with enclosed texts).

Any recording on which the above three artists figure is bound to be one of major interest and this remains true even if, as in this case, some of the music is quite unmemorable. And when I say such a thing about Schubert's works, you may safely believe me.

If some of these pieces are less than first-rate, little real blame attaches to poor Schubert. He was a tune-smith, not an intellectual and he was also a very easy-going sort of chap; if someone gave him a manuscript to be set to music or suggested they'd like a piece for some particular occasion, Schubert usually complied, however unsuitable the material might be, however unsuited to his talents.

The first side is taken up by three large pieces: "Hermann und Thusnelda", "Antigone und Oedip" and "Cronnan"; broad dramatic scenae, which simply were not the kind of writing to appeal to Schubert.

Even in pieces such as this, Schubert's genius for a good singing line did not desert him, but they do verge on the dull and sung by lesser voices would hardly hold an audience.

Side 2 starts with a set of wordless Vocal Exercises which, despite their prosaic purpose, sound quite delicious. Schubert at his very best emerges in the Nocturne "Licht und Liebe" and "Mignon and the Harper", both lyrical and of great effectiveness. It is in these songs that the two singers also are heard at their very best.

The rest of side two is taken up by "Selma und Selmar" and "Hektor's Abschied", works of little significance and, finally, a scene from Goethe's "Faust" — the cathedral dialogue between Gretchen and Mephisto, with a latin choir in the offing. Although this, also, was not an ideal text for Schubert's purpose, his respect for Goethe was such that he made a much greater effort and the resultant music succeeds very well.

As might be expected, all the singing and accompanying are out of the very top-drawer and the disc's technical quality is also excellent.

★ ★ ★

MOZART — Concerto for 2 pianos & orchestra in E flat major, K.365; Concerto for 3 pianos & orchestra in F major, K.242. Denise Duport, Muriel Slatkine, Oswald Russell, pianos; Colleqium Academicum de Geneve, conductor Robert Dunand. Concert Hall stereo SMS 2742.

While these works are far from being unique on disc (they are, I regret, very much so in public performance), any disc offering them must be welcomed. In this particular case, although the record is made in Australia, I am not quite certain about its general availability and suggest you check before ordering.

The performances on this record are not, I think, madly exciting or truly outstanding ones — and I am grateful for this. These concerti are not virtuoso pieces, to be absorbed with bated breath. They are, in

that much-abused term, music for pleasure — for the pleasure of the participants as much as for that of a listener.

As regards K.365, it is a truly lovely work and its best performance on disc was probably that by Paul Badura-Skoda and Reine Gianoli on a long-deleted Westminister disc. If the present version fails to scale such heights, it is still a very good one.

The concerto for 3 pianos was quite brilliantly recorded by the Casadesus family on a 1964 issue from C.B.S. — I doubt that it is still about — and later, less spectacularly, by members of the Menuhin family on a 1967 M.M.V. disc. Here again, the present disc need not be an improvement. What matters is that, in both works, the playing is very stylish, there is obvious love for the music, the orchestral assistance is good and tasteful, the conducting sound and the recorded sound agreeable.

★ ★ ★

IMMORTAL BAROQUE MELODIES — Collegium Academicum de Geneve, conducted by Robert Dunand. Concert Hall stereo SMS 2694.

When I see a record titled as this one is, I shudder and run away; when I am obliged to review it, I lack that freedom and, at the least, must sit down for the duration. Which, of course, is very good for me in every conceivable way — and which, as it happens, almost cured my initial snobbery. Almost: I still fail to see why so idiotic a title should have been adopted for so pleasant a disc.

Although, no doubt, some of the items on this record may be "immortal", they are not fairly described as "melodies", the less so as several are presented in very sophisticated arrangements. The one thing in the title which fits is the tag "baroque". The life-span of the ten composers represented on the disc ranges from 1634 (Charpentier's birth) to 1778 (the death of Rousseau) and there is thus a true unity of time. Happily, the choice of works is such that they present the utmost in variety, proving that even in so limited a period there was much scope for individual styles and modes of expressions.

Both the orchestral playing and the quality of the recording are very good and I'll do no more than outline the contents of the disc very briefly. The disc commences with excerpts from a "Te Deum" by Charpentier — a very grand spectacle, full of the brilliant sound of trumpets. Then comes a Telemann Largo, a graceful and courtly piece for solo viola & strings, formal yet without stiffness. An Aire & Minuet by Purcell is both less formal and more animated but, in the Minuet, bordering on the common-place.

The next item, Adagio Cantabile by Tartini, though a trifle dull, is a sweet and smooth-flowing example of baroque fiddle-display. The finale from Handle's Organ Concerto No.12, as also the Allegro from No.13, on the second side, are occasions for some truly lovely 18th-century organ sound.

There are three very characteristic pieces by Rameau, a bucolic and gay extract from Rousseau's "Le Devin du Village", a very delicate movement from an oboe concerto by Dall'Abaco, a fair arrangement of Bach's Chorale "Sleepers Awake", a pleasant Purcell Rondo.

To convince listeners that, in the Baroque, everything was possible, the disc ends with a marvellously lush, dignified and somehow liturgical-sounding Adagio by Albinoni, probably the finest exponent of Italian music of its kind, with all its rich sweetness and emotional exuberance. One should, of course, not be satisfied with such brief excerpts but I will admit that, as a well-chosen sampler of baroque music, the disc will be hard to beat. The only obvious omission is of Spanish music, but I presume this will be covered by some other collection.

★ ★ ★

VIVALDI — Il Cimento dell'Armonia e dell' Invantione, opus 8. Igor Ozim, violin; Pierre Rosso, oboe; Collegium Academicum de Geneva, conductor David Josefowitz. Concert Hall stereo SMS 2676 (3 discs, boxed).

Lest anyone should be left in any doubt, this issue contains the complete set of twelve concerti of opus 8 — the first four of which have become well known as "The Four Seasons". To my knowledge, this is only the second occasion on which the whole of opus 8 has been offered in a single set; actually, this one goes one better as it contains fourteen concerti.

If I seem to be talking nonsense, here's the explanation: the concerti No.9 in D minor and No.12 in C major exist in two versions — one for violin and one for oboe. On this set, for the first time, we get both versions! I am not trying to be facetious: we really do get all the twelve concerti for violin & orchestra, plus two of them repeated by oboe and, as it happens, I am very pleased to have been offered the alternatives.

Violinist Igor Ozim is not, I think, world-famous. It so happens that he has toured Australia (for Musica Viva) and I can say that he is very good, very musicianly and greatly matured since we heard him here in 1959.

Vivaldi does not call for any grand virtuosity in 20th-century terms and Mr Ozim seems to me to manage very well in most respects, even if I could have wished for more precise intonation here and there. Pierre Rosso (a Swiss?) is an excellent oboist and I remain undecided as to which of the alternate versions of the two concerti is the better, the more convincing.

It is some years since I'd last heard the whole set of twelve concerti and I am now convinced that the first four do not deserve to be singled out for frequent performance. The remaining eight works, in their various ways, are every bit as good and as delicious — all they lack are catchy titles! Probably none would want to hear twelve Vivaldi concerti at a single sitting; but, allowing for that, this is a thoroughly pleasing set, well played, agreeably recorded and bound to give a great deal of pleasure to most listeners.

★ ★ ★

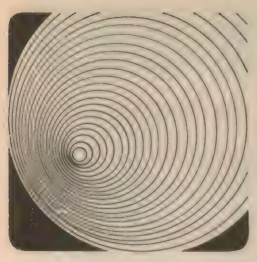
BEETHOVEN — Piano Sonatas No.7 in D major, op.10 No.3; No.14 in C sharp minor, op.27 No.2 ("Moonlight") and No.25 in G major, op.70. Alfred Brendel, piano. Philips stereo 6500 417.

How appallingly presumptuous music students and their teachers are! At the age of sixteen, I was encouraged to believe that I could "play" this quite difficult D major sonata. Brendel, of course, CAN play it, but only after much soul-searching and a profound study of Beethoven's thought and music.

When I first heard Brendel play Beethoven — during his first Australian tour, exactly ten years ago, I was not favourably impressed and I did not much care for his interpretations of these same sonatas when he recorded them for Vox about 1965. The present set is very different indeed, both in interpretation and as a recording. Gone is the early brashness and excessive egocentricity; Brendel supplies exemplary sleeve-notes which explain coherently what he is about, what he considers Beethoven was about and how it all fits together.

It is, of course, infuriating that such a great artist should be able to communicate clearly in words as well as in musical sounds — but I am very grateful to him for both efforts. As regards the sound, it is wholly pianistic and intimately warm, ideal for the music offered.

The whole of side 2 contains the D major sonata which I have not enjoyed as much since Solomon's day. The still rarely-heard opus 70 receives a gracious and worthy reading; as for the ubiquitous "Moonlight" sonata — well, I don't think any but the ultra-romantics could find fault with it.



VARIETY FARE

REVIEWS OF OTHER RECORDINGS

Devotional Records

MODERN CHURCH MUSIC'S Greatest Hits. Various artists. Stereo, Move MS-3006. (From Move Records, 660 Swanston St, Carlton South 3053).

Many tend to have reservations about modern hymns (a) because they're not old and (b) because the composers and musicians are much too young to be spiritually mature! And "Greatest Hits"? Tut, tut!

But, seriously, this is an excellent album upon which to reflect, or to provide a basis for discussion. As the notes point out, the concept of "Greatest hits" is always suspect but it is true that all the titles presented here have won acclaim in different church groups throughout Australia; ten of them are designated for inclusion in a proposed new Australian hymnal.

There are 18 tracks in all: How Lovely Is Your Dwelling Place — The Strife Is O'er — My Song Is Love Unknown — The Wedding Banquet — Like The Deer That Yearns — When I Needed A Neighbour — King Of Glory — The King Of Love — The Church's One Foundation — Every Star Shall Sing A Carol — Come O' Jesus — Lord Of The Dance — O Jesus Crucified — Father In Heaven — Sing Christ Risen — In Faith And Hope And Love — Song Of God's Presence — Seek, O Seek The Lord.

Featuring the work of Jim Minchin, Sister Miriam Therese Winter, Sydney Carter, Richard Connolly and others, this is an interesting album and one that could win a lot of playing. (W.N.W.)

★ ★ ★

THE CHURCHMEN. Try A Little Kindness. Stereo, Word WST-8530-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

I hadn't listened very far into this album when I began to get the feeling that I had reviewed it some time ago. I've certainly heard it. But I didn't search back through past issues because it's good enough, anyway, to warrant a further mention. The Churchmen are five young Canadians who produce a happy mix of the traditional and up-tempo which is likely to have a very wide appeal. On second thoughts: their "Happy Day" might be just a little too happy for Grandma!

They sing: Try A Little Kindness — No Place To Hide — Then Jeus Came — Jesus Is Coming — Turn Around — Why Should I Worry Or Fret — Oh Happy Day — Closer To Thee — That's Enough — The Love Of Jesus — Somebody Bigger Than You And I.

The sound is clean and well balanced and, if it's of interest, it emerges very well from simulated quadraphonic playing. The Churchmen obligingly stay out front but the instrumental backing comes from just about everywhere else. (W.N.W.)

★ ★ ★

GOSPEL TRAIN, Reverend Mose Davis, Jonathan Harper, Bill Jackson and the Glory Singers. Sonic Stereo 9040 Astor release.

This is one of the brightest gospel records I have heard in many a day, with a group of performers who sound as if they thoroughly believe in what they are singing. The backing has a driving rhythm that would make the record a good starter for a youth group sing-along.

Some of the favourites on the disc are: To My Father's House — Oh Happy Day — Michael — Gospel Train — When The Saints Go Marching In — We Are Goin Down Jordan — He's Got The Whole World In His Hands — Glory Hallelujah. The recording quality is excellent, with very clear diction on the part of the singers.

I'm something of a conservative when it comes to music with a religious theme but this did not spoil my enjoyment of this disc. (N.J.M.)

★ ★ ★

GABRIEL'S MOTHER'S HIGHWAY. Franciscus Henri. Move stereo MS 3007 (From Move Records, 660 Swanston St, Carlton South 3053).

By whatever standard you judge it, this is an excellent record. The recording quality is especially good and the performance is outstanding with Franciscus Henri doing the vocals and Brian Cadd, rising star on the Australian pop scene, playing the piano or organ. Backing them up are Rick Berger on drums, Phil Gardner on guitar and Nick Alexander on piano. The songs? Life from a Christian viewpoint. But it is well presented — not the introverted, narrow-viewpointed sort that some of this material can be.

Song titles: Gabriel's Mothers's Highway — Bitter Was The Night — Coming Or Going Away — Green Like The Leaves — Sixty Years On — Seventh Queen Street Hymn — Song Of The Morning — The Candlelight — Judas And Mary — Friendship. (L.D.S.)

Instrumental, Vocal and Humour

FAMOUS ITALIAN OPERA CHORUSES. Chorus and orchestra of the Royal Opera House, Covent Garden, conducted by Lamberto Gardelli. Studio 2 Stereo TWO 390.

There is some very fine singing and playing from the very experienced Covent Garden artists in this collection of opera "chestnuts". A listing of the titles should be sufficient to enable you to make up your mind about purchasing: Va Pensiero, from Nabucco (Verdi), in which Hebrew slaves sing sadly of their homeland — Fuoco di gioia, from Otello (Verdi), the "welcome home chorus for Otello — Verdi! le fosche notturna, from Il Trovatore (Verdi), the famous "Anvil Chorus" — Regina Coeli . . . Innegiamo, from Cavalleria Rusticana (Mascagni), the "Easter Sunday Hymn" — Humming Chorus, from Madame Butterfly (Puccini) — Gira le cote from Turandot (Puccini), sung by a mob awaiting the execution of a failed suitor — Patria opressa, from "Macbeth" (Verdi) — a lament by the oppressed Scots — Per poca fa le tenebre, from Lucia di Lammermoor (Donizetti), the Marriage Contract scene — Dell tuo stellata soglio, from Moses in Egitto (Rossini), a prayer led by Moses — Che interminable andirivieni from Don Pasquale (Donizetti), a "servants' gossip" chorus — Gloria all'Egitto, from Aida (Verdi), the popular triumphal march chorus.

This is not a collection of old tracks collated from various recordings, but a new recording in EMI's Studio 2 Stereo system, and the sound is accordingly of excellent modern standard. (H.A.T.)

STARLIGHT CHORALE. Famous opera choruses. The Roger Wagner Chorale and the Hollywood Bowl Symphony Orchestra, conducted by Robert Wagner, Stereo, Columbia SENC 10023.

Here is another collection of popular opera choruses performed specially for a recording, but here it is a re-issue on a budget price ($2.99) label of an older recording. While the sound quality is good, it cannot compare with the latest recordings technically, and there are only eight titles compared with 11 in the Studio 2 recording reviewed elsewhere. Titles common to both are the "Triumphal March" from Aida; the Anvil Chorus from Il Trovatore; and the "Humming Chorus" from Madame Butterfly. In addition, there are: March and Chorus from "Carmen" — Pilgrim's Chorus from "Tannhauser" — Wedding Chorus from "Lohengrin" — Waltz and Chorus from "Faust" — Soldiers' Chorus from "Faust".

The fine singing and competent orchestral accompaniment leave no scope for criticism. Good buying at the price. (H.A.T.)

★ ★ ★

LUDWIG (The Mad King of Bavaria). Music by Wagner and Schumann from Luchino Visconti's film. Various artists and orchestras. Stereo, His Master's Voice SOXLP 7569.

Unlike most films, Visconti's film apparently used standard classical works complete, allowing them to run continuously behind the dialogue when actual performances were not being screened. The tracks collected here are not from the actual soundtrack, but have been selected from the E.M.I. archives. Some are fairly

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlquist (G.W.), and Norman Marks (N.J.M.).

VARIETY FARE

old recordings, but for a medium priced disc offering 51 minutes playing time, this is acceptable enough.

The items are: Prelude to Act 1, from "Lohengrin" (Wagner) — Scenes from Childhood (solo piano, Schumann) — Love Duet, from Tristan and Isolde (Wagner, arr for solo piano) — Siegfried Idyll (Wagner) — Oh! Star of Eve from "Tannhauser" (Wagner) — The "Porazzi Theme (Wagner).

The performances are all of a high standard, and thus this is a disc which can be enjoyed purely for its musical content, as well as a souvenir of what is apparently an outstanding film. (H.A.T.)

★ ★ ★

REQUEST CONCERT FROM THE GREAT OPERAS. Choir and Orchestra of the Hamburg State Opera; London Philharmonic Orchestra; conductors Leopold Ludwig, Reinhard Linz, Horst Stein. Stereo, Europa (Astor) E 320.

There are no solo highlights in this selection, which consists entirely of overtures, marches and choruses, all extremely popular items, all sung in German, and all splendidly performed by one of Germany's premier opera companies, with contributions from the London Philharmonic.

The selection: Sailors' Chorus from "Flying Dutchman" (Wagner) — Overture to "The Bartered Bride" (Smetana) — Huntsmen's Chorus from "Der Freischutz" (Wber) — Clog Dance from "Czar and Carpenter" (Lortzing) — Wach Auf from "The Mastersingers" (Wagner) — Pilgrims' Chorus from "Tannhauser" (Wagner) — Slaves Chorus from "Nabucco" (Verdi) — Soldiers' Chorus from "Faust" (Gounod) — Toreadors' March from "Carmen" (Bizet) — Anvil Chorus from Il Trovatore" (Verdi) — Coronation March from "The Prophet" (Meyerbeer) — Triumphal March from "Aida" (Verdi). Good singing and playing throughout, and very well recorded. (H.A.T.)

★ ★ ★

THE WORLD OF THE ORGAN. Various organs, artists. Stereo, Decca series 299 SPA-262.

Unless you are already over-supplied with grand organ recordings, and these works in particular, you should make a point of picking up this budget priced Decca album.

To abbreviate the titles heavily, the nine tracks include: Toccata & Fugue D minor (Bach — Richter — Victoria Hall, Geneva) — Chorale Prelude (Bach — Ropek — St Giles, Cripplegate) — Fantasia and Fugue in G minor (Bach — Ropek — St Giles, Cripplegate) — Symphony 5 Toccata (Widor — Demessieux — Liverpool Cathedral) — Piece Heroique (Higginbottom — Corpus Christi College, Cambridge) — Trumpet Tune (Purcell — Preston — Westminster Abbey) — Solemn Melody (Davies — Rees — Alltwen Chapel, Glamorgan) — Trumpet Voluntary (Clarke — Preston — Westminster Abbey) — Adagio For Organ And Strings (Albinoni — Haas — Wurtemburg Chamber Orchestra).

An outstanding characteristic of the recording is its complete freedom from distortion and noise, and its excellent frequency response. This, in addition to its musical content, makes it a real bargain. Recommended. (W.N.W.)

★ ★ ★

WARM, WILD & WONDERFUL. Tony Mottola plus the NOW sound. Project 3 stereo (quadraphonic) SPJL 933045.

Its been some time since I've heard a new album from the Enoch Light stable but this one is a beauty. Easy on the ear all the way. Great for dining, driving or just relaxing. Hopefully Festival will release it on cassette for the motorist. Tony's guitarist and backup musicians have never sounded smoother. The recording quality is excellent and my sample had no surface noise. What a rave review!

Twelve track line-up: This Guy's In Love With You — Do You Know The Way To San Jose — Dream A Little Dream Of Me — With A Little Help — Scarborough Fair — Watch What Happens — By The Time I Get To Phoenix — Kites Are Fun — Cry Me A River — Goin' Out Of My Head — Love In Every Room — I Found Love. (L.D.S.)

★ ★ ★

MANCINI SALUTES SOUSA. The Concert Band sound of Henry Mancini. Stereo, RCA Victor APLI—0013.

While those with an ear for arrangements and sound texture will doubtless be able to identify the Mancini touch, the sound and the impact of the new release is Sousa all the way. If you like Sousa marches, therefore, there's a strong chance that you'll thoroughly enjoy this Mancini / Sousa album. The reverse is true, of course.

The tracks: Stars And Stripes Forever — U.S. Field Artillery March — The Invincible Eagle — National Fencibles —

Washington Post — Semper Fidelis — The Thunderer — The Gladiator — King Cotton — El Capitan.

The "Concert Band Sound" of Mancini is very much a military style band, very precise, recorded with a minimum of reverberation and recorded very cleanly. Real hifi material!

But there's an odd angle to the disc. From a reference in the notes, a CD-4 version is obviously available and, while I would have been interested to have heard it, the stereo version sounded fine — played through a matrix! But, in respect to the last track, this is the understatement of the year.

Right in the middle, without the slightest warning, a high speed jet fighter hurtles overhead followed by another and another. I mean hurtles, and I mean overhead. It's the most stunning piece of quad that I can remember and it emerges by accident of matrixing from an RCA disc! I'll be saving that track up for future occasions. (W.N.W.)

★ ★ ★

HORACE FINCH plays the organ of the Empress Ballroom, Blackpool Mono BBC Records 129M. (From Discovery Records, Box 4037 Melbourne 3001, or 44 Anderson St, South Yarra, Vic.).

In this stereo age, why would one want to pay $5.95 for a record old enough to be branded "mono"? The first is that it's a recording of two BBC broadcasts made respectively in 1958 and 1959 in the twilight era of the big Wurlitzers and the men who played them.

The second is that the performances are by Horace Finch, one of the old brigade, of the Reginald Dixon era but less well known in this country. But if you want a sample of the skill of the era, this record might be hard to beat. The registrations, the improvisations, the complex counter melodies are quite outstanding; and remember that this was a live on-air performance, on a big pipe instrument, in a huge auditorium, without the assistance of any electronic trickery or double recording.

Each side is divided into two long tracks, each presumably a segment of the original "light program" broadcast. The major themes are "Dancing Through The Years," "Yesterday's Tunes," "Memories Of Jolson" and "Tunes Of The 50s."

It's a mono recording which I stretched a bit by playing it through a 4-channel system. However the quality is quite reasonable and certainly adequate to allow an organ enthusiast to study the techniques of one of the BBC's old time featured artists. (W.N.W.).

★ ★ ★

NO NO, NANETTE. David Johnston plays the Dendy Wurlitzer. Stereo, Coonara KDN 101001. (Discovery Records, Box 4037, Melbourne 3001 or 44 Anderson St, Sth Yarra. $3.98).

Most popular organ enthusiasts will know that the organ featured here is the 3-manual pipe Wurlitzer installed in the Dendy Cinema and the pride and joy of the Victorian Division of the Theatre Organ Society. David Johnston is resident organist at the theatre by night. By day, he plays, installs and maintains electronic Baldwins and Rogers instruments.

Here, in true and competent theatre style, he plays the music of "No, No, Nanette" and other Vincent Yeomans' favourites: Overture — Tea For Two — Telephone Girlie — Where Has My Hubby Gone Blues — Too Many Rings Around Rosie & You Can Dance — I Want To Be Happy — Without A Song — I Know That You Know — Happy Because I'm In Love — Why Oh Why — Rise N' Shine — Medley.

The music is tuneful and the performance will please theatre organ enthusiasts. The recording itself is well balanced but the general level is a little on the low side and this, combined with a certain amount of instrument and tape noise might worry the hifi fan but this is not unusual with theatre organ recordings. (W.N.W.).

★ ★ ★

MUSIC OF THE GREAT BANDS. Recreated by Frankie Carle. From the 50's. Calendar stereo R66.

When I first received this album I looked at it with a jaundiced eye (my other eye looked elsewhere). After all, an album of declared plagiarisms can be a drag. But no, it was very well done. Frankie Carl "does" some of the bands so well that you'd swear it was the original band but for the fact that it is a high quality recording in stereo. To sample, have a listen to "Lullaby of Birdland" with the George Shearing Quintet or "September Song" by Stan Kenton.

The other tracks are listed as follows, with the appropriate band in brackets: Love For Sale (Ted Heath) — Nina Never Knew (Sauter-Finnegan) — Dizzier And Dizzier (Dizzy Gillespie) — My Funny Valentine (Gerry Mulligan) — Hot Toddy (Ralph Flanagan) — Night Train (Buddy Morrow) — Man With A Horn (Ray Anthony) — Rock Around The Clock (Bill Haley's Comets) — So Rare (Jimmy Dorsey). L.D.S.)

VARIETY FARE

250 YEARS OF FILM MUSIC. The London Symphony Orchestra, conducted by John Keating. Studio 2 Quadraphonic, TWO 398.

No, it's not a misprint, and the title as given above appears on the disc jacket. The explanation is that the music featured, as used in various films, was composed over a period of about 200 years, beginning with Bach and finishing with Richard Rodney Bennett, whose music for "Nicholas and Alexander" is the only item not composed by a recognised classical composer, if we include George Gershwin's "Rhapsody in Blue" in this category.

The other titles are: Romeo and Juliet (Tchaikovsky) — Polovtsian Dances (Borodin) — Suite No 4, last movement (Bach) — Sabre Dance (Khachaturian) — Adagio in G minor (Albanoni) — Adagietto from 5th Symphony (Mahler) — The Thieving Magpie (Rossini) — Symphony No 3, slow movement (Brahms) — Dance of the Sugar Plum Fairy (Tchaikovsky) — Firebird Suite, finale (Stravinsky).

Obviously, these pieces could not be accommodated on a single LP "in toto," and the kind of chopping and arranging resorted to by Mr Keating will not be appreciated by experienced listeners to the classics. However, those who have come to enjoy these fine melodies through the medium of the cinema will no doubt find them enjoyable enough. The sound quality is fine. (H.A.T.)

★ ★ ★

SOUNDS OF TODAY. 101 Strings. Astor stereo S 5279.

For those not familiar with the 101 strings they put out music similar to the Melbourne Show Band or Eric Jupp and his orchestra. I hope people connected with these two orchestras will not feel insulted by the comparison but it seems fair enough. The music arrangements are quite pleasant for uncritical listening while relaxing or driving but recording quality leaves something to be desired in parts.

Only ten tracks are featured: Man Of La Mancha — The Impossible Dream — American Trilogy — Country Rock — Manhattan Rhapsody — Amazing Grace — We've Only Just Begun — Something — Curtain Time — Discotheque. (L.D.S.)

★ ★ ★

I'M ON MY WAY. Tony Fenelon at the Dendy Wurlitzer, Stereo, Festival Harlequin series L-25052.

"I'm On My Way" is not only the title tune of this album, it's also an appropriate prologue to Tony Fenelon's third tour of the United States. And, despite the fact that the album was recorded in one mind killing sitting between 2am and 6am in the darkened theatre, there's not the slightest hint of fatigue: it's Tony Fenelon in the form that has already wowed theatre enthusiasts in the States. The program:

I'm On My Way — Cabaret — Without A Song — Anything Goes — Eriskay Love Lilt — Man Of La Mancha — When You're Smiling — Under The Double Eagle — Try To Remember — Swanee — Waltz In A-flat — Broadway Rhythm.

The recording itself is clean and well balanced and it sounds all the better for 4-channel presentation. Recommended. (W.N.W.)

★ ★ ★

FERRANTE AND TEICHER. United Artists stereo L 45221 / 2. 2-record set $7.95.

Both the discs in this two record set have been issued before but they definitely do not show the famous piano duo at their best. The piano plus orchestral arrangements lack life and give no indication of the showy music that Ferrante and Teicher have a reputation for. Quality is standard. (L.D.S.)

★ ★ ★

GLEN CAMPBELL Presents Carl Jackson, banjo player. Capitol stereo Senc. 10022.

Glen Campbell on guitar and nineteen year old Carl Jackson on banjo, together with a rhythm group romp through ten numbers with a strong country and western flavour in this enjoyable record. Half the numbers are composed by Carl Jackson. These include: C.J's Breakdown — Song For Susan — Ole Miss — James Louis Henry — Aint Got No Name. Other titles are Duelin' Banjos — Orange Blossom Special — Little Rock Getaway — Say Old Man — Foggy Mountain Breakdown.

Sound quality is excellent and good use is made of stereo, particularly on "Duelin' Banjos". (N.J.M.)

★ ★ ★

LET'S GO OKTOBERFEST. Will Glahe and his Orchestra DECCA Stereo TV-SS13.

Will Glahe certainly captures the spirit and gaiety of the Munich Oktoberfest in this bright and happy record of party and drinking songs. The sound quality is excellent, as one expects from this label, with the leader's accordion leading a typical German brass band in sixteen popular tunes such as Radetzky March — The Skaters Waltz — Leichtensteiner Polka — Drink, Drink, Drink, Little Brother — Beer Barrel Polka — Cuckoo Waltz — Horn Polka — Auf Weiderseh'n Sweetheart (N.J.M.)

★ ★ ★

LES CHANSONS IMMORTELLES. Various French cabaret artist(e)s. Stereo, Columbia SOEX 10024.

Edith Piaf presents her famous performances of "Milord" and "Je ne regrette rien", and Gilbert Becaud offers "Et Maintenant" in the only worthwhile style, in French with bolero rhythm. These are what I believe many people will find the most interesting tracks in this selection. Becaud also sings "J'attends", and the remaining artists and chansons are: Charles Aznavour with Sur Ma Vie and Une Enfant; Adamo with Tombe la Neige and Quand les Roses; Enrico Macias with Mon Couer d'Attache and Enfants de Tous Pays; Richard Anthony with Donne Moi Ma Chance and Aranjuez Mon Amour.

Obviously, there are two generations of performers here, and I must confess to be better acquainted with, and more attuned to the Piaf / Becaud / Aznavour group than the younger performers of the second group. However, "chacun a son gout" — you may like the younger artists better, or both equally. It's your decision. Obviously, the age of the recordings varies considerably, and the Piaf tracks are presumably reprocessed stereo, (and if so skilfully done) but the others sound like genuine stereo, and the sound is of acceptable standard throughout. (H.A.T.)

VARIETY FARE

THE WORLD IS A CIRCLE. DISNEY-LAND Stereo Ster. I352 E.M.I. Release. Release.

There is no mention of the orchestra or vocal group performing on this collection of film hits with a special appeal to children but that shouldn't spoil your enjoyment of the disc. Three of the numbers are from the current film, "Lost Horizon" and the others from "Fanny", "South Pacific" and "Hans Christian Andersen." The quality on the tracks, "The World is a Circle", "Living Together," "Growing Together" and "Question Me and Answer" is excellent, but the others, "Dites Moi", "The Inch Worm", "Be kind to your Parents" and "I Like You" is somewhat variable. (N.J.M.)

★ ★ ★

CHARLIE McCOY. Monument stereo PL 34783.

Charlie McCoy's harmonica has a plaintive sound, not without charm, but a whole album of C&W harmonica plus backing gets to you after a while. It would be far more pleasant if those instruments and harmonica backed a good singer. And that's not meant unfairly. C&W music without singers lacks a lot.

Recording quality is good and surface noise is negligible. Buy it to sing along to.

Eleven tracks are featured: Me And Bobby McGee — I'm So Lonesome I Could Cry — Delta Dawn — The First Time Ever I Saw Your Face — I Can't Stop Loving You — Grade A — I Really Don't Want To Know — Woman — To Get To You — Danny Boy — Rocky Top. (L.D.S.)

★ ★ ★

MOON OVER ITALY. Ronny King, Trumpet and the Gerhard Narholz Orchestra. Ace Of Clubs Stereo SCLA. 7049 E.M.I. Release.

A very pleasant record as a background to a meal or as music to relax to would be my description of this disc of twelve well recorded numbers with a predominant Italian theme. The trumpet solos are a little dominating but not to any objectional extent. Some of the titles are: A man without love — Palazzo — Una Lacrima sul viso — Al di la — Amor, Mon amour — Lo che non vivo — Quando l'amore diventa poesia — La notte.

Except for a slight crackle on the inner tracks, the quality is very good. (N.J.M.)

★ ★ ★

COMEDY CARAVAN. Andy Griffith, Stan Freberg, Yogi Yorgeson, Harry Karis, Johnny Standley. Capitol mono ENC I0003.

If nothing else, this record demonstrates how comedy tastes have changed since these tracks were originally recorded; some of them must be over twenty years old. The artists and their numbers are: Stan Freberg — "John and Marsha", "St George and the Dragonet", "Little Blue Riding Hood". Andy Griffith — "Romeo and Juliet", "What it was, was Football". Yogi Yorgesson — "The Object of My affection", "The Bees and the Birds". Harry Kari — "Yokahama Mama". Johnny Standley — "It's In The Book".

It is interesting to remember a lot of the lines in some of these tracks that became part of everyday talk, especially amongst teenagers.

If your old enough to remember the originals, give the record a hearing but I'm afraid it would be lost on a lot of today's young sophisticates. (N.J.M.)

★ ★ ★

AL JOLSON. Played by Sunset Dance Orchestra. Sunset stereo US 9988.

Many people will buy this record off the stands, sound unheard (as opposed to sight unseen) because of the title, pictures and life-story of Al Jolson on the cover. But it's a potential "have." It is merely a collection of tunes made popular by Jolson played by a pleasant enough dance band. Sound quality is okay.

Twelve tracks are featured and each is a dance arrangement played in more-or-less strict tempo: Swanee — After You've Gone — Pretty Baby — Back In Your Own Backyard — Anniversary Song — Sonny Boy — I'm Sitting On Top Of The World — Chinatown, My Chinatown — Toot Toot Tootsie Goodbye — Carolina In The Morning — Baby Face — My Mammy. (L.D.S.)

★ ★ ★

PROMISES, PROMISES. Lynn Anderson. Interfusion Stereo IFTL 3497, Festival Release.

Sad love songs with a strong country and western flavour would be the most apt description of this record by this young singer with a true and powerful voice. She sings a dozen mostly well known songs with a good rythm backing that carries the whole thing along at a smart pace.

Some of the tracks are: Promises, Promises — The Worst Is Yet To Come — Crying — Love Of The Common People — A Penny For Your Thoughts — I've Been Everywhere (with American place names) — Paper Mansions — Sing Me A Sad Song — A Hundred Times Today. The sound, recorded in RCA's Nashville sound Studios, is bright and of good quality with sensible use of stereo. (N.J.M.)

★ ★ ★

EVERYTHING IS IT. Heikki Sarmanto Big Band. Columbia stereo SCXO 8013.

Sometimes I feel even the record companies know some of their records are "going to bomb out." This is one of them. Big Band from Finland. No jacket notes. Sounds mostly terrible. Tortured even. Goodnight. (L.D.S.)

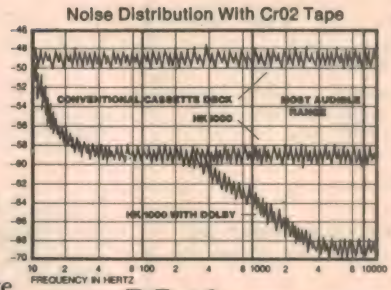
★ ★ ★

REMEMBER MARILYN. Marilyn Monroe. Century Records mono TL34861.

Well, the secret is definitely out. For those too young to remember (and I am one of those) Marilyn Monroe was not a singer. True, she was not tone deaf but singing was not one of her strong points. Anybody who thinks otherwise is deluding himself. She might have won the Eurovision Song Contest if Mrs Mills was the only other competitor. As if that's not bad enough, the sound quality is absolutely terrible. (L.D.S.)

Never before has this little noise accompanied this much music.

If you're sophisticated enough to be reading this magazine, you're probably familiar with the two main characteristics of cassette decks: hiss and nonlinear frequency response.



Noise.

Which should make you thoroughly unfamiliar with the performance capabilities of our new HK-1000. As the charts indicate, it behaves more like reel-to-reel than a cassette deck:

Signal-to-noise (unweighted) is −58 dB with Dolby and −70 dB in the audible hiss level above 4,000 Hz. The frequency response curve is essentially flat from less than 30 to beyond 15 kHz, ±1.5 dB, with CrO_2 tape. (This curve is due largely to the way we drive our heads. Instead of the conventional constant *voltage* drive to the head, the HK-1000 is designed for constant *current* drive. Many studio model reel-to-reel decks are designed the same way.)

Because of a new low in noise and a new wide in frequency, the HK-1000 brings you a new clarity in music.

Ours is the first cassette deck designed for maximum phase linearity. Square wave response is better than every other cassette deck and even some expensive reel-to-reel decks. And the better the square waves, the cleaner and more transparent the music.

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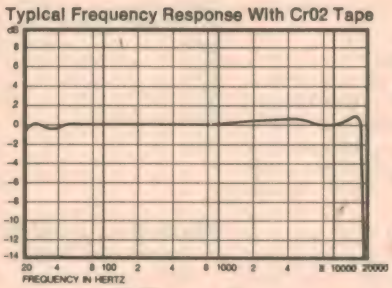
The HK-1000 is also designed so you can use it often without endangering it. Plug-in printed circuit boards are used for simplicity and reliability of operation. Heads are easy to reach and clean. And the transport is the most reliable we've ever tested; it even closes with the sort of reassuring "thunk" you normally hear only by closing the doors of expensive hand-built cars.



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VARIETY FARE

VICTOR BORGE LIVE AT THE LONDON PALLADIUM. Stereo. Astor SPLP 1408.

Those who have seen Victor Borge on stage or on television might be inclined to the view that his act would lose much of its impact in sound only. However, this is not the case, at least for me and my family, who sat convulsed with laughter almost throughout the whole lengthy playing time of this disc. Only in one spot, towards the end of Side 1, was there a very short period when the audience was obvously seeing something very funny, while the disc listener was at the disadvantage of not being able to participate.

The following quote from the sleeve note tells much about the drolleries on the disc: "His dry observations on . . . Lyndon Johnson . . . who lifts our hero up by the ears (you may remember the famous beagle dog incident). His interlude with a delightful blonde soprano . . . whom he employs simply to insult; She is not allowed to touch his piano . . . 'And I don't touch her soprano.' The Russian opera where at the end you might wonder what happened to Mr Borge's voice . . . he ends up with the microphone in his mouth! And there is a delightful piano duet with his 'Turkish' assistant, Sahan Arzruni."

The sound is not particularly good, but the humour is first rate. (H.A.T.)

★ ★ ★

MORE BIG SIXTEEN. Gene Pitney. Musicor stereo ML-34584.

The sleeve notes of this record reveal what is probably the pop-world's best kept secret — that Gene Pitney is still popular with teenagers around the world. Surely, this only applies to teenagers local milk-bar hasn't changed the jukebox record these last ten years! And that would be a good reason for him to be unpopular. Maybe I'm wrong. Maybe David Cassidy and the Partridge Family are a mirage and Gene Pitney really is going strong.

Here are the latest tracks from Gene Pitney: It Hurts To Be In Love — Oh Annie Oh — Today's Teardrops — Fool Killer — Laurie — Hawaii — Little Betty Falling Star — Brandy Is My True Love's Name — I'm Gonna Be Strong — Hello Mary Lou — I Love You More Today — Half The Laughter, Twice The Tears — Lyda Sue, Wha'Dya Do? — Not Responsible — Every Breath I Take — I Laughed So Hard I Cried. (L.D.S.)

★ ★ ★

LE GRAND CHARLES. Charles Aznavour. Barclay Stereo BCL 34639. Festival release.

Paul Mauriat's orchestra gives a solid backing to the intimate singing style of Charles Aznavour on this recording of French songs, mainly composed by the artist, and sung in his native tongue. Some of the dozen titles are: Tu T'laisses — Plus Heureux Que Moi — La Nuit Les Deux Guitares — Rendez-vous a Brasilia — Monsieur est Mort — Comme des Etrangers. Recording quality is excellent. If French ballads are your thing, give this disc a hearing. (N.J.M.)

★ ★ ★

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STILL POINT. Madder Lake. Mushroom stereo MRL 34915.

The thing that hits you about this Melbourne group is their neck-snapping sound. It is sharp and electrifying in an original and intelligent way.

So many heavy rock groups from overseas simply go ape with noise. Madder Lake have carefully structured a number of tracks, each of which holds the listener's attention from Go to Whoa.

"Goodbye Lollipop" is the best and simplest of them. A two-word lyric is all it has. That must be hard to beat today yet it says all that needs to be said about growing up.

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VARIETY FARE

Members of the group are John McKinnon, gravel voiced singer and keyboard man; Mick Fettes, vocals; Brendon Mason, lead guitar; Jack Kreemers, drums, congas, gong; Kerry McKenna, bass synthesizer and vocals.

John Francis engineered the disc at TCS studios in Melbourne. I think it must be one of their best productions yet. I can't wait for them to get something on to a quadraphonic master. Surely this would be a worthwhile subject for a Federal cultural grant? (G.W.)

★ ★ ★

SHAFT. Bernard Purdie. Prestige stereo SPRL 934554.

Drum solos still get applause from jazz audiences, not from me. Purdie is a drummer and you can't blame him for strutting his stuff on the Isaac Hayes tune "Shaft" which features Houston Person in a tenor sax solo and Lloyd Davis on guitar. Purdie's group is almost in the boogaloo style of jazz. There is some diverting electric piano played by Neal Creque on "Summer Melody." The LP's final track is a typical ride-out tune which builds in tension, featuring Willy Bridges, the composer of the tune, on tenor sax and Gerry Thomas on trumpet. (G.W.)

★ ★ ★

VISIONS. Mike Quarmby. CBS stereo SBP 234385.

This Adelaide singer and composer has made a brilliant first album, in his home town, too.

A 16-track recorder was driven by John Widgery and Mike Fitzhenry for the sessions, producing a big sound with Quarmby who, in fact, has a rather light voice.

One of his best songs, "Someday the Sun" would be superb sung by a bass baritone. Quarmby has a pleasant voice, quite equal to the task at most times. He plays acoustic guitar very well and the sound has been captured accurately.

There are a couple of country-style jam sessions, the best of them being "People, People, People," which features Jock Munro on guitars; Sandy Mathewson, bass; Dean Birbeck, drums; Glenn Henrich, piano, tenor sax, clarinet, soprano sax, vibes recorded and percussion (a busy boy), Mike Smith banjo and fiddle; Trevor Warner, fiddle and dobro and J. Alan Slater, electric piano and organ. (G.W.)

★ ★ ★

WILD FIRE. Rusty Bryant. Prestige stereo SPRL 934607.

Bryant comes straight at you on tenor saxophone in this blues-rock based jazz album.

There are six numbers on the LP and the most intriguing is an improvisation on "Riders on the Storm" a joint composition by the members of the Doors. There are solos by Jimmy Ponder on guitar, Bill Mason on organ and Bryant on sax.

Bryant has a big, boisterous style, well suited to rousing a dance crowd. On "The Alobama Kid" he blows hard and fast, repeating the odd phrase, calling the cattle home. (G.W.)

★ ★ ★

FOREIGNER. Cat Stevens. Island stereo IL 34884.

Stevens recorded this one at Kingston, Jamaica, and had his group on hand. The title piece is a suite which takes up the whole of side one. Like most Stevens lyrics, the meaning is not clear. He seems to be a foreigner to his girl freind and he crawls back to her, over-doing the praise.

The LPs best songs are on side two, starting with "The Hurt," one of the best songs Stevens has written. It is personal and searching, sung by Stevens who accompanies himself with that staccato piano style. (G.W.)

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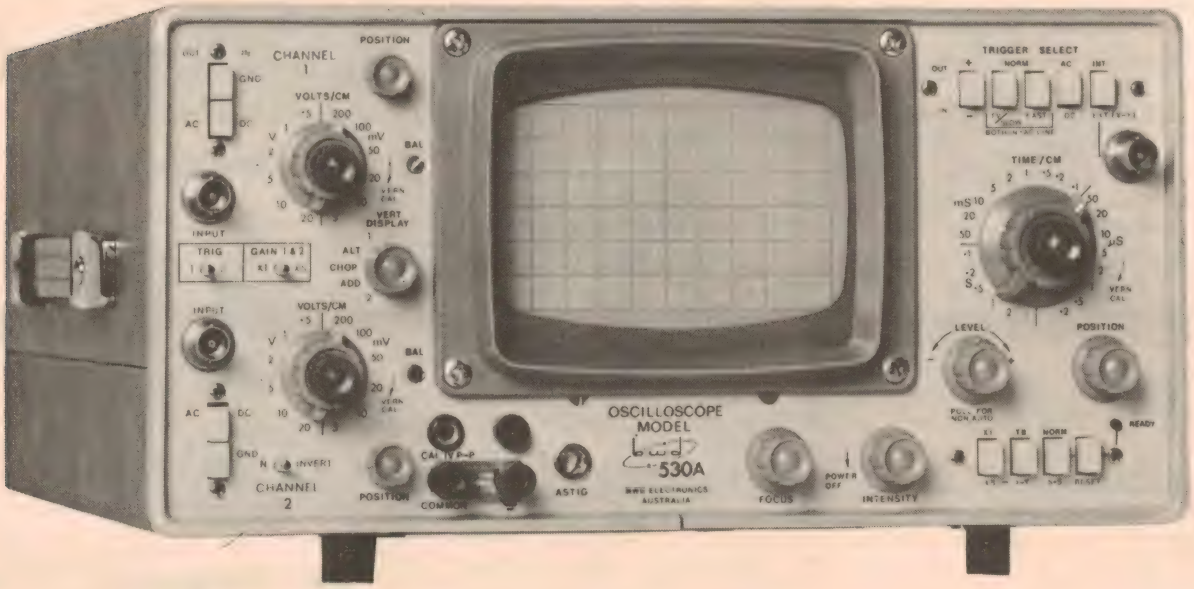

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PRODUCT REVIEWS AND RELEASES

Direct drive capstan on Technics deck

Interesting features of the new high-quality Technics RS-276US stereo cassette deck are Dolby Noise Reduction, a directly driven capstan and separate motor for tape spooling and all solenoid control. As an optional feature, a remote control unit is available at extra cost.

As cassette decks go, the Technics RS-276US machine is posibly the largest, measuring 440 x 115 x 325mm (W x H x D), and also the heaviest at 9kg. The control-panel is satin "scratch-grain" aluminium and low-gloss charcoal finish with some portions being simulated leatherette. The cabinet is of oiled teak.

Dominating the left-hand side of the control panel are the two large VU meters which are illuminated and clearly calibrated, and slightly tilted towards the user. All signal controls plus the revolution counter and memory facility are laid out in orderly fashion below the meters, while the tape transport control buttons are immediately below the cassette well. All signal inputs and outputs are on the rear panel with the exception of the headphone socket, which is deeply recessed into the front of the case.

The tape transport mechanism and control system is quite complicated and includes three solenoids, six relays and ten micro-switches. As a result of the solenoid actuation, the RS-276US is one of the few cassette machines with push-buttons which can be operated with reasonably light finger pressure. Some cassette machines require unreasonably high pressure on their push-buttons or control levers. The solenoid operation also makes it possible to operate the RS-276US by remote control, if required.

A revolutionary feature of the machine is the direct drive system for the capstan. To our knowledge, this is the first cassette machine with such a drive system. It employs a 16V brushless DC motor together with its own semiconductor control circuitry. This method of drive has several advantages, the first being simplicity. With less moving parts, there are less sources of wow, flutter and rumble. Another advantage is the machine is not tied to the mains frequency. Finally, the user does not have to periodically replace belts, which can be a real bugbear in a tightly crammed chassis.

Like several other machines in its class, the RS-276US has automatic tape shut-off and memory rewind, both of which appear to be controlled by a photocell. Only one belt is used in the machine — to drive the rev counter. A separate 12V motor is used to drive the cassette reels.

Input and output level controls are provided on the control panel. In the past we have tended to regard output level controls on the control panel as merely "dressing-up" the panel and tended to favour preset level controls instead. However, the output controls on this machine do have the advantage that they control the level fed to the headphone socket which can be a handy feature. The headphone socket recess, by the way, is too small to accept the rather large moulded plug on some headphones (eg. the Stanton headphones reviewed in these pages).

Two small concentric knobs provide Dolby level adjustment in conjunction with the special Dolby tape supplied with the unit. Here we must comment that we believe these controls should be relegated to the rear panel as screw-driver preset controls. It is all too easy to inadvertently alter the settings when recording or on playback so that operations have to be interrupted to reset the controls.

Bright indicator lamps are provided to indicate the mode of operation and facility being used, and they are labelled: Play, Record, Dolby and CrO2 (for Chromium Dioxide tape). Curiously, in a machine of this calibre, there is no overload indicator or alternatively, any Automatic Limiter as found on some recorders. Some users may feel that the large, easily read VU meters give an adequate signal level indication but they often cannot indicate high frequency and / or transient overloads.

Another feature of the machine which is not seen but heard is the so-called HPF head which has a ten-year guarantee. We gather that HPF stands for "hot-pressed ferrite" or something similar. At any rate it is claimed to have improved wear characteristics, hence the ten-year guarantee and superior and longer lasting frequency response. This is because the very fine gap can be accurately produced and since wear is not a problem the gap does not "wear open" and so deteriorate the high frequency response.

Having described most of the major features of the unit, we can discuss its performance and "handling". For a start, this is certainly the easiest and most foolproof transport control system we have experienced. A motoring journalist would probably like to state that it is "ergonomically" well designed. For example when the user jabs the Stop bar, he is less likely to hit some other button than with other decks because the Stop bar is closest to the edge. And the Record and Eject buttons are over by themselves on the LH side of the deck so that they do not interfere with play and rewind modes.

Recording levels are easy to set up on the unit. Just connect the source, push the record button and set the input level controls so that the meter needles just swing up to OVU on signal peaks. Then push the Play or Pause button to initiate recordings. In the play mode, tape take-up is unbelievably fast and there is absolutely no audible transition from stop to normal tape speed. Only solenoid control and a capstan motor with plenty of torque and inertia (flywheel effect) can give this result. In this respect, the Technics unit is comparable with the finest reel-reel machines with solenoid control.

Wow, flutter and rumble appeared to be inaudible and are certainly now at a level where they do not present a problem with most cassettes. Rewind time of C60 cassette is approximately 100 seconds.

Calibrations of the VU meters were quite accurate and better in this respect than most other makes. The meter can be driven well into the red on recording without distortion becoming too obtrusive, although high frequency response does suffer quite markedly if the meters are regularly

(Continued on page 109)

High quality Stanton headphones

NEW PRODUCTS

Stanton Magnetics are well known for their magnetic cartridges but they also make two high-quality stereo headphone sets, the Dynaphase Forty and the Dynaphase Seventy-Five. The latter model is of particular interest because it has separate low and high frequency "loudspeakers" and LC crossover networks.

Stanton headphones are impressive in appearance, with black padded headbands and ear surrounds and blue earpieces. All metal surfaces are chromed. The earpieces are large and bulky at 110mm in diameter. The padded ear surrounds are removable for cleaning or replacement.

Dealing with the less expensive unit first, the Dynaphase Forty headphone set has large "loudspeakers", for a headphone, with a baffle opening of approximately 80mm. Nominal impedance at 1kHz is 9 ohms, although this is of little note to the user and little importance to the amplifier since they are usually driven via isolating resistors. The hemispherical mouldings which enclose the back of the loudspeakers are vented unobtrusively to improve the low frequency response. The unit has a connecting cord of a practical length — approximately 3 metres (10ft).

Wearing comfort with the Dynaphase Forty headset is good. The ear surrounds are well padded and the weight of the units is such that they can be worn for long listening sessions without undue fatigue. By way of comment, all headphones seem to cause some fatigue because of the weight on the listener's ears and the fact that the ears become hot because they are so well sealed by the ear surrounds.

Listening quality is well balanced with good bass reproduction and the high frequency response is pleasant without being too extended. In other words, they sound typical of many good-quality medium priced headphones. Apart from their comfort and listening quality, their handsome presentation is likely to be the major selling feature.

The Dynaphase Forty and Seventy-Five headphone sets are shown above and at right respectively.

Far more ambitious in concept are the Dynaphase Seventy-Five headphones. These have a low frequency driver very similar in looks to the unit employed in the model Forty headset. Mounted concentrically with and immediately in front of the "woofer" is the high frequency "tweeter" which has a baffle opening of 44mm. The woofer radiates from slots all around the tweeter opening. Each earpiece has its own inductor-capacitor cross-over network.

Instead of the usual straight connecting cord, the model Seventy Five has a coiled cord linking the plug to the control box, and then a straight cord from control box to headset. Total length when extended is 4 metres (13ft). The control box has individual volume and tone controls for each channel and a stereo / mono switch. The tone controls appear to act as bass boost control rather than a "top-cut" control.

Even after allowing for the weight of four drivers plus cross-over network components, the weight of the headset is high at approximately 840 grams (30 oz). Combined with the weight of the cord and control box, the total weight is over 1kg.

Listening quality of the model Seventy-Five is dramatic. They have the best bass response we have experienced from a pair of headphones to date. By comparison, the treble is nowhere near as extended and tends to suffer by comparison. However, as long as the bass boost on the control box is not set at maximum and a little treble boost is applied at the amplifier (after all, this is what tone controls are for) overall balance is very good.

A disadvantage of the unit is the weight. The listener needs to sit in a high-backed lounge chair to rest his head, otherwise he suffers from neck fatigue. Part of the problem is that the control box is suspended inevitably between the amplifier and the user, even though it has a clip which enables it to be fastened to a coat pocket.

Be that as it may, our impression is that most users will decide that the above disadvantage is a worthwhile price to pay for the superior bass response and impressive overall sound quality.

Further information on Stanton headphones may be obtained from authorised dealers or the Australian distributors for Stanton equipment, Leroya Industries Pty Ltd, 266 Hay Street, Subiaco, WA 6008. (L.D.S.)

Technics tape deck contd.

"flicking into" the red. For best results, the meter should run just up to OVU on the highest peaks. The signal-to-noise ratio is such that this practice produces much better frequency response without background tape noise becoming too obtrusive.

With a high quality low-noise tape, we measured unweighted signal-to-noise ratio off tape at minus 50dB with respect to OVU, which is one of the best results we have obtained. With chromium dioxide tape, signal-to-noise ratio was not as good but still adequate by cassette standards, at minus 40dB. Dolby noise-reduction gave the usual improvement at frequencies above 5KHz.

With the low noise tape, frequency response at a recording level of minus 20VU was within plus and minus 3dB from 20Hz to 13kHz, with rapid roll-off beyond 14kHz. Surprisingly, response was little better with chromium dioxide tape at plus or minus 3dB from 20Hz to 14kHz, with rapid roll-off again beyond 14kHz.

Clearly, the big selling feature of this machine is its mechanical refinement. Driving it is easy and trouble-free. At its price it is certainly expensive but it should give years of satisfaction. Recommended retail price is $439, slightly higher in some states.

Further information on Technics equipment can be obtained from the Australian distributors, Haco Distributing Agencies Pty Ltd, 57 Anzac Parade, Kensington, 2033. (L.D.S.)

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BWD Electronics Pty Ltd, 331-333 Burke Road, Gardiner, 3146.

Calculator LEDs

Fairchild has announced two new low cost nine-digit monolithic displays for the pocket calculator market. The new displays, the FNA35 and FNA37, consist of nine monolithic numeric displays and nine decimal point LEDS assembled on a printed circuit board.

The FNA35 is constructed with 0.050 inch characters which are magnified by a built-in bubble magnifier to increase apparent character height to just under 1/10 inch (.092 inch). If desired, a bar magnifier and lens can be added to further increase apparent height to 0.130 inch.

Typically the FNA35 requires 0.5mA average drive current per segment with a 1/9 duty cycle, or 4.5mA peak current. This allows direct drive from standard MOS logic, which can source 5mA. Light output at 0.5mA per segment is 8 ucd.

The FNA37 is constructed with 0.070 inch characters, which are magnified by a built-in red bar magnifier and lens to increase apparent character height to slightly more than 1/8 inch (0.130 inch). Although the FNA37 is specified at 1mA average drive current per segment, typical operation is at 0.5mA per segment. This allows MOS logic to drive the segment directly when using a 1/10 duty cycle (6mA peak current). Light output is typically 9 ucd at 1mA average current and 5 ucd at 0.6mA.

In addition to the FNA35 and FNA37, Fairchild also manufactures another PC board display, the FNA30, which has a 0.100 inch character height, unmagnified. This selection gives calculator designers a wide range of digit height and pricing choices.

Fairchild has also announced that it will serve as an alternative source for the 8T series of line drivers and receivers. The series includes the 8T13 and 8T14 general purpose driver and receiver, and the 8T23 and 8T24 IBM compatible driver and receiver.

Fairchild Australia Pty Ltd, 420 Mt Dandenong Rd, Croydon, Vic.

CORRECTION

The A & R Soanar advertisement which appeared on page 103 of our August issue in reference to their well-known Battery Eliminator PS 164 incorrectly described it as a Battery Charger. It should have been "Battery Saver". We regret any confusion this may have caused our readers.

Digital switch has 7-segment display

A digital switch of radical design has been introduced by McMurdo. Designed around the DIL package system, it gives an 8421 BCD encoded output and also a visual 7-segment decimal indication. The display numerals are 11 x 7mm, while the assembly height is only 11mm. Three versions are currently available, while an illuminated version will be released soon.

The switch is claimed to be ideal for batch counters, measuring devices and controls where preset BCD values are required.

McMurdo (Aust) Pty Ltd, 19 Carinish Rd, Clayton, Vic 3168.

"...(The Dynaco A-25) has established a new standard of performance in uncolored, natural sound."

THE HI-FI NEWSLETTER (P.O. Box 539, Hialeah, Fla. 33011)

"...you'll have a hard time buying more musical naturalness at any price."

THE STEREOPHILE (Box 49, Elwyn, Pa. 19063)

The critiques from these hobbyist magazines have unusual merit as these publications accept no advertising. Their comparative evaluations are funded solely by the subscriptions of ardent audiophiles.

The A-25's sound quality is a direct consequence of its smooth frequency response, outstanding transient characteristics, and very low distortion. Its aperiodic design (virtually constant impedance over its range) provides an ideal load so any amplifier can deliver more undistorted power (and thus higher sound levels) for a given speaker efficiency.

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AMATEUR BAND NEWS & NOTES

by Pierce Healy, VK2APQ

Royal Canadian Mounted Police Centenary

Amateur radio is participating in celebrations to mark the 100th anniversary of the world renowned Royal Canadian Mounted Police. Many Australian amateurs have contacted the special station set up for the event.

Amateur radio has played a unique role in the public liaison aspect of the celebrations to commemorate the 100th anniversary of the formation of the Royal Canadian Mounted Police. This role has been to give world wide publicity for the event, as only amateur radio can.

Canadian licensing authorities issued a special call sign, VE3RCMP, for a station to be manned by amateurs within the force. Besides being a distinctive call sign allowing the use of appropriate phonetics, it is, as far as can be ascertained, the first four letter call issued to an amateur station.

The station, in the Ottawa headquarters of the RCMP, commenced operation on 3rd June, 1973, initially for three months. During this period more than 5,000 contacts were made with amateurs world wide. The chief operator was Ron Bellville, VE3AUM.

Among the first Australians to contact VE3RCMP, was Harry Caldecott, VK2DA, of Balgowlah, Sydney. Harry alerted the Sydney Chapter of the Quarter Century Wireless Association, to this special event station. Details were also given in weekly news broadcasts from WIA divisional stations, resulting in many contacts with VE3RCMP from Australia.

Harry also suggested that they should seek permission to extend the period until the end of 1973. This would enable contacts to be made with amateur stations who had been unable to work them during the three months. Also, the world wide interest in the station, the organisation it represented, and the nature of the event, seemed to warrant such a move.

During one of the early contacts, Harry asked Ron to convey to RCMP Commissioner, W. L. Higgitt, best wishes for their centennial anniversary, from members of the Sydney Chapter, QCWA. During a subsequent contact, the commissioner's acknowledgement and appreciation of the greeting were relayed through Ron.

The suggestion to extend the period was taken up by Ron and official approval granted. VE3RCMP will now continue until 31st December, 1973.

To enable Australian stations to make contact, operating times will be from 1130 hours GMT (9.30 pm EST) on 14170kHz SSB.

Harry Caldecott has been appointed Australian QSL manager for VE3RCMP.

From contacts with VE3RCMP some very interesting historical information has been obtained. Since its institution in 1873 the force has had three changes in name and three changes in uniform. Many will be surprised to learn, as tourists have found, that the colourful red jacket uniform is not the everyday dress, but the "Review Order of Dress."

There are 11,000 members in the RCMP. Of these 22 are amateur operators.

To many, a Canadian Mountie is just a brightly uniformed individual displaying good horsemanship or a romantic hero in some film scenario.

Maybe, apart from its long respected motto "Maintiens le Droit" or "Maintain Justice," it has been that image that has in some small way helped to gain them the respectful affection that is seldom heard expressed of similar organisations.

A booklet giving some highlights of the history and work of the RCMP tells of the increasing public interest during the early 1950s, which brought about the appointment, in 1952, of a liaison officer at headquarters in Ottawa.

The liaison office endeavours to create and maintain good relations throughout the wide range of the RCMP national and international contacts and to provide a source of information to all those genuinely interested in its work.

The booklet gives the following telecommunications details:

". . . the RCMP maintains mobile networks with control stations at divisional and sub-divisional headquarters located in provincial capitals and many of the larger centres. These are linked with some 525 radio-equipped detachments and the latter with some 1,500 patrol cars. Well over 150 hand-carried portable units are also employed to link policemen on foot with his patrol car, a feature that has proven particularly valuable during searches for lost persons in bush country and over rough terrain.

"A teleprinter network ensures the fast dissemination of police information to the various divisions and sub-divisions across Canada . . . all units are connected with headquarters at Ottawa.

"Concurrent with the rapid development of Canada's far north has been the increase in the Force's responsibilities in that area, making swift communications between northern detachments essential. To meet the situation, the Force is establishing a vast and versatile communications system stretching from the Alaskan border to Frobisher Bay and north to Grise Fiord. Completion of the project will enable some 30 stations to communicate with each other and with aircraft and other stations on a common frequency.

"Ships and aircraft of the RCMP 'Marine' and 'Air' Divisions are equipped with the most modern radio facilities and are capable of communicating with most of the fixed and mobile units of the Force, with Department of Transport air service and with naval stations.

"Rapid communications being essential to successful operation of INTERPOL, the Force from its headquarters at Ottawa, maintains radio contact with some 24 stations in Europe, the Middle East, North Africa and South America, through INTERPOL headquarters at Paris.

"Installation, operation and maintenance of RCMP radio equipment is carried out by the telecommunications branch which maintains some 32 repair and maintenance workshops equipped with the most up-to-date facilities available."

The RCMP has many facets which provide interesting reading. Without doubt the centennial anniversary is a highlight. It is true to say that amateurs throughout the world are pleased to see their hobby now connected with the historic celebrations of this renowned organisation.

The operators of VE3RCMP have done a great job for their organisation and amateur radio. The use of amateur radio on occasions like this is one of the many ways it can be of value to the community and the promotion of international goodwill.

To Ron, VE3AUM and the other operators, thanks for the opportunity to join in the celebrations and for the interesting information supplied.

Featured is the striking VE3RCMP, QSL card (unfortunately not in colour) which will probably become a collectors' item.

QSL card issued by VE3RCMP, the amateur station set up to mark the centenary of the Royal Canadian Mounted Police. The station will be operating until the 31st December 1973.

WIRELESS INSTITUTE ACTIVITIES

Repeater Frequency Saga

An Extraordinary Convention of the WIA was held at the Victorian Division rooms on Saturday, 15th September, 1973. The meeting was requisitioned by the South Australian Division, in accordance with Article 15 of the Articles of Association of the federal body of the WIA.

The chief item for discussion at that meeting was the subject of VHF, FM repeater frequencies.

On Sunday, 16th September, 1973, the official broadcast from the Victorian Division station, VK3WI, read a communique giving details of the decision. The following is a transcript:

"After intensive and prolonged deliberations, both at the extraordinary convention and during the intervening hours between sessions, the following policy was established . . . to be known as the 'WIA two metre band plan'.

"Subject to PMG Departmental approval being obtained, the repeater input channel frequencies shall be: —

146.10MHz	146.30MHz
146.15MHz	146.35MHz
146.20MHz	146.40MHz
146.25MHz	

output frequencies shall be 600KHz above the input frequency for each channel.

"Simplex channel frequencies shall be: —

146.45MHz	146.60MHz
146.50MHz	146.65MHz
146.55MHz	

with 146.50MHz to be developed as the national simplex channel and 146.60MHz as the national RTTY channel.

"A channel numbering system numbering each 50KHz spacing will be implemented."

NEW SOUTH WALES

A special general meeting of the NSW division, WIA, was requisitioned by five members to consider a motion "that this division withdraw from the federal body." The meeting was held on Friday night 21st September, 1973, at Wireless Institute Centre. There was a large attendance of members.

A number of speakers expressed their views on the proposal and associated aspects of WIA organisation and management. Some of the points made by the speakers indicated that there was some room for improvement, at both divisional and federal levels. However, little support was forthcoming for the motion as put forward, and it was defeated; 22 for, 274 against.

Arising from points raised by speakers, a motion was put by Pierce Healy, VK2APQ, that the Federal Consitituion be reviewed by the NSW division constitution committee, and any amendments throught desirable be recommended as possible agenda items at the WIA federal convention in Sydney during 1974. This motion was carried unaminously.

It was also suggested that some aspects of the NSW

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, 2200.

division constitution, particularly that of calling special general meetings, be reviewed at the same time.

Illawarra Branch

A 432MHz earth-moon-earth test was made on 2nd September, 1973, with K2UYH and W6FZJ.

Signals from K2UYH were much better than ever before. This was due to the gain obtained by Al, K2UYH from his new 28 foot dish antenna over that obtained from his previous 20 foot dish.

Several of his transmissions were copied solid at the Illawarra site at Dapto, signals peaking to 7dB or more above the noise. Lyle Patison, VK2ALU, reported that for the first time signals were heard louder than their own, reflected from the moon. The transmissions from VK2AMW at Dapto were not copied by K2UYH as well. This was due to the much lower power being used by VK2AMW.

Signals from W6FZJ were detected but were not readable.

Lyle advises that, according to the Dutch publication VERON, both G3LTF and F8DO in Europe conducted tests with a number of stations in North America on the last weekend in August, over the 432MHz e-m-e path. Results were not then known.

Further progress is being made with the design and installation of club room facilities at north Wollongong. The committee's aim is to make the decor and facilities of a standard that they will be proud to show visitors.

For details of the Illawarra Branch, write to the Secretary, Ian Bowmaker, VK2ZJA, PO Box 110, Dapto 2530.

Central Coast Amateur Radio Club

Preparations are well in hand for the 17th annual Club Field Day. The event will be on Sunday, 24th February, 1974. The venue is the Gosford Showground, on the western side of, and just to the north of, the Gosford Railway Station.

The program has been finalised and will include some suggestions made by visitors to the 1973 field day. Full details in a future issue of these notes. However, now is the time to plan for that enjoyable trip to the Central Coast. There is plenty of motel accommodation in the area, providing bookings are made reasonably early. So why not miss the Sunday morning traffic and make it a pleasant weekend for the family at Gosford.

Ed Dyring, CCARC publicity officer reports, "Although it is hoped that the entire operation will be held outdoors, including the trade displays, there is ample cover facilities should the weather be unkind. So, do not let the threat of rain keep you away from this most popular day."

WESTERN AUSTRALIA

The 1973 annual general meeting of the West Australian VHF Group was held in July. In a report on the year's progress, the secretary stressed the importance of the opening of the Wireless Hill museum and VK6WH, and the facilities it offered.

The solid state beacon VK6RTV has been on test at VK6PD location. It has a power output of eight watts to a ground plane antenna. FSK has been used to minimise keying problems so that a simplified power supply could be used. So far the safety devices have not been completed.

Considerable progress has been made on the 144MHz transceiver project.

TASMANIA

The Tasmanian Division Golden Jubilee Hamfest will be held over the weekend 24th-25th November, 1973. The venue is Avondale, near the Launceston airport.

Program:

Saturday 24th, 1400 hours: Hamfest commences and will include — mobile clinics for equipment to be used in events the following day; trade displays and the inevitable eyeball QSO's.

1830 / 1930 hours: Dinner at the hamfest site. Wine, dine and dance until —?

Sunday 25th, 1000 hours: HF and VHF scrambles; hidden transmitter hunts.

1300 hours: Barbecue lunch.

1430 hours: Further hunts and scrambles.

1600-1700 hours: Presentations and farewells.

Alternative entertainment will be provided for the ladies and children.

There are camping and caravan facilities close to the Hamfest site.

Further information from R. L. Harwood, VK7RH, 5 Helen Street, Launceston, 7250.

VICTORIA

Moorabin & District Radio Club

A Moorabbin Youth Expo was held at Moorabbin Town Hall on 27th and 28th August, 1973. The active and static displays by the MDRC attracted a large proportion of the public.

A closed circuit TV display created a lot of interest. Radio communication was also demonstrated, using the club station VK3APC. Contacts were made on two metres FM and 80 metres SSB.

The club's 25th Anniversary Dinner will be held on Saturday 1st December, 1973, at the Commodore Hotel Sandringham. The Ladies Auxiliary Group also organise theatre-supper parties and smorgasbord dinner and dance evenings as part of the club's social activities.

Club meetings are on the 1st and 3rd Friday of the month, at 8.00 pm, in the Moorabbin Baseball Clubrooms. Further details from the secretary, D. M. Rosenfield, VK3ADM, 5 Lygon Street, South Caulfield, 3162.

Geelong Amateur Radio & TV Club

The Geelong Amateur Radio Club and other radio groups will be holding a "Get-together" picnic at Stigletz, on Sunday 25th November, 1973.

Details of the proposal have been sent to other groups and it is expected that this will be an excellent opportunity to meet other amateurs and their families.

Starting at approximately 10.00 am, there will be no charge and the picnic will be a "BYO" affair.

If the weather is unfavourable announcements will be made of FM channel 1 (Melbourne) and FM channel 4 (Geelong and Gippsland) and channel B.

The result of a survey into the Geelong repeater, VK3RAG channel 4, was: A majority believe an independent group is required to be responsible for its operation. Location at Mt Anakie is preferred and higher output power was generally requested.

During the next couple of months, the four dipole array used at the old Bayview location will be removed, overhauled and installed at Mt Anakie during the summer months. This will give greater coverage and help to eliminate a few local dead spots. The output power (7 watts) will be increased later in the year.

"How will VHF be affected?" This was the heading of a note in the September GARC Newsletter.

"Astronomers predict that a comet discovered in March this year, is heading towards the earth. It should be visible in our morning sky in November and December and the evening sky in January. Since last month the comet has been hidden by the sun. Astronomers predict that this comet will be more spectacular than 'Halley's Comet'.

"It will be interesting to see what can be done on the VHF bands."

The GARC meets every Friday night in their club rooms Storrer Street, East Geelong. Visitors are welcome For details write to the Secretary, Alan Bradley, VK3LW, Geelong Amateur Radio and TV Club, PO Box 520, Geelong, Vic 3220.

WIA YOUTH RADIO SCHEME

In his monthly club news sheet, Kev Watson, VK2BLW, NSW state supervisor for YRCS, draws attention to the importance of club leaders strictly supervising on-air activity. While this aspect of YRCS training is important it should not be allowed to be a major activity and interfere with class training.

"It can happen that a club . . . gets equipped with a side-bander. The novelty of this piece of equipment can certainly arouse the ego in all to get on the air . . . If not watched . . . very soon classes become secondary, sometimes forgotten, study is pushed aside for a week, maybe two weeks until the novelty has worn off to some extent.

"Even though a small problem on the surface, it could become a monster and cripple or even destroy a good club. This does not mean that there should be no on the air activities. On the air activity should be taken advantage of in clubs at all times, but it should be controlled, arranged as part of the club's training program, with on the air periods organised and the equipment used as an inventive."

SOUTH AUSTRALIA

Elementary certificate examinations have been held recently at the Port Augusta and Elizabeth Radio Clubs. At Port Augusta elementary certificates were gained by Hank De Witt, Traviss Just (Credit grade) and Cromer Just, Robert Janoska (Pass grade). The successful candidates at the Elizabeth Radio Club were: James Martin, David Anderson, Alan Griffiths and Peter Mills (Pass grade). The Elizabeth has discontinued regular meetings for the remainder of the year but club members will participate in group outings to a radio broadcasting transmitter and a barbecue picnic.

At the time these notes were being prepared the St Mary's Boy Scouts Youth Radio Club were arranging a visit to a broadcasting station. Some of the club members assisted in log keeping during the Remembrance Day Contest.

The Stradbroke Scout group have made enquiries about starting a youth radio club.

Mr Graham Johnston, VK5SS, of Port Pirie Youth Radio Club, advised that renovations to the club rooms are continuing with the assistance of the older club members. They have four classes operating, one elementary grade, two junior grade and one intermediate grade. One of the junior classes has reached examination standard.

The Port Pirie YRC won the Institution of Radio and Electronics Engineers pennant in South Australia for 1971.

Youth Radio Club stations again assisted in the Boy Scout Jambouree-on-the-Air in October.

During the period 28th December, 1973-7th January, 1974, the Youth Radio Club Scheme will be represented at the 10th Australian Scout Jambouree at the South Australian Scout training centre, "Woodhouse" in the Adelaide hills. South Australian Scout station, VK5BP will be operating from the site and visitors to the station will be given information on the YRCS.

NEW SOUTH WALES

University of NSW Radio Society

The University of NSW Radio Society have been given the use of a room at the Jewish residential Shalom College for their club sctivities and to establish an amateur station. Permission has also been given for the erection of antennas. The club is now seeking items with which to equip the station. Donations of such items will be appreciated.

Full membership is available to any person at the University of NSW, the subscription being $2.00 per year. Associate membership, at $1.00 per year, is available for those outside the University. Meetings held each Wednesday at 1.00 pm. All welcome.

Persons interested in obtaining the AOCP are invited to join the study group to be formed at the end of this year. Write to "The Study Group," University of NSW, The Union, Box 57, Kensington 2033. Applicants will receive details by mid-December.

The society's first activity day was held recently, consisting of a trip to Wollongong. Members unfamiliar with amateur radio were shown how mobile equipment, including antennas for two and six metres, was installed. Operating techniques were also explained.

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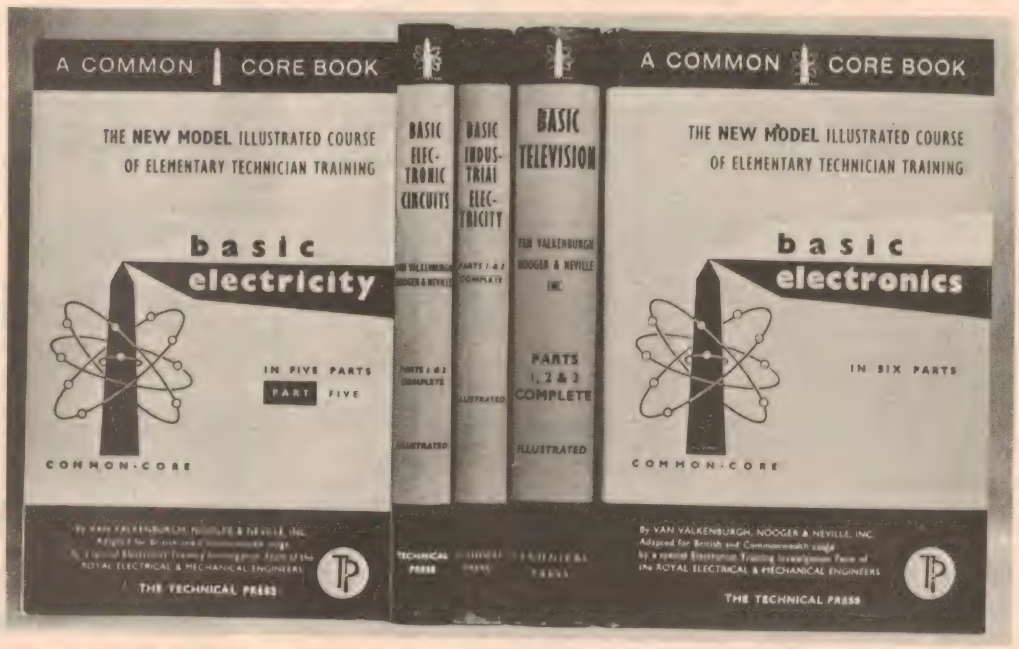

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(If under 21, signature of parent or guardian)

Name.....
(Block letters below)

Address.....
(Full postal)

.....

Steve, VK2ZFF, has been appointed technical projects officer on the UNSWARS committee. His job will be to organise technical projects for unlicensed members. A start has been made to develop transistor convertors for the 80, 40 and 6 metre bands. This will enable those joining the study group to gain knowledge by building equipment and to listen to Morse code practice sessions, using a convertor ahead of an ordinary broadcast receiver.

President Sam Voron, VK2BVS, advises that they will be pleased to assist anyone in a high school or technical college to establish a radio club. Write to the address given above.

St George YRCS Training Annex

At a recent meeting of Annex students, consideration was given as to why a country like Australia, with a population of 13 million people, has barely 7,000 radio amateurs.

Among the reasons advanced, was one criticising the AOCP examination paper. It was pointed out that candidates were told to answer only seven out of a choice of nine questions, and all questions carried the same marks. However, all questions had two parts, while some even had three or four sections to answer.

The time limit of 150 minutes was not enough to cover the writing time required, and there was no time for checking answers. Some questions required a page and a half of mathematics, a time consuming exercise. Some questions would be expected in the commercial operator's examination.

Anticipating the novice licence, the elementary radio theory lectures have been rearranged to comprise an entertaining and fully illustrated audio/visual presentation. This includes valve and transistor theory through to the simple transmitter and receiver principles.

Intending students are advised that classes are filling rapidly. Do not delay. Join now. Ring Noel Ericsson, VK2MF, for details on 59 1658 or write to 17 McIntyre Avenue, Brighton Le Sands, 2216. Correspondence courses are now being considered.

Westlakes Radio Club

The legal and bank formalities have been completed by the trustees of the Westlakes Radio Club. As these notes were compiled plans were being finalised for the removal of the building at Dora Creek and resiting it at York Street Teralba. This is the result of six months intensive work on the part of the club committee. There are a number of jobs to be done before the building can be used for club activities. It is expected that these will be completed over a short period by club members.

The Westlakes Radio Club committee have expressed their appreciation of a very generous gift of $500 towards the club's own premises. The donation was by Mr W. S. (Bill) Otty, VK2ZL, of Fennells Bay, Toronto, NSW. Bill has been an amateur for more than 60 years and has helped many to gain their licence.

In preparation for novice licencing, Morse code classes are being held at the WRC. Those interested should contact the club director, Joe Waugh, VK2IQ at the club any Saturday afternoon.

Until the new premises are ready, meetings and YRCS classes will be held at the present address, Ranclaud Street, Booragul. For information contact the secretary Eric Brockbank, VK2ZOP, PO Box 1, Teralba, 2284.

Dubbo Amateur Radio Club

The Dubbo Amateur Radio Club, VK2BMA, has amalgamated with the Police Citizens Boys Club at Dubbo.

Over the past few years the radio club has faced difficulty in retaining members, especially the younger ones. This was due to not having permanent club premises where practical and theory instruction could be given on a regular basis.

An approach to the Police Citizens Boys Club was received with enthusiasm and in a short time the club was given their own lockable room on a permanent basis. The room is more than adequate for the Club's purposes.

A 10 metre high mast has been erected in the yard adjacent to the club to carry the 80, 40 and 20 metre dipole antennas. A two metre beam, constructed by Ces Kearines, VK2AKC, was fixed on top of the mast and no difficulty is experienced in working through the repeater at Orange.

It is hoped that, now permanent premises have been obtained, the club membership will increase and produce more amateurs in the Western Region.

The club is desperately short of equipment and any help from other clubs will be greatly appreciated.

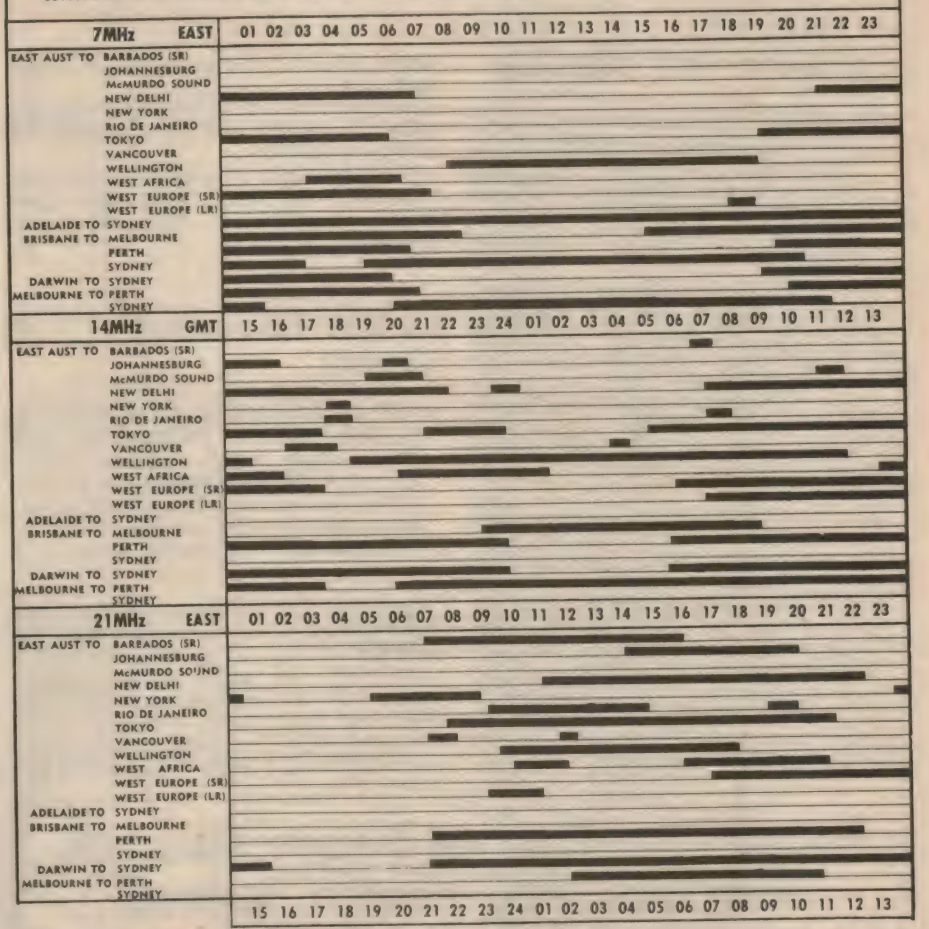
Regular club meetings will be held on Friday nights at 7.30 pm and on Sunday mornings at 10.00 am.

Anyone interested in joining is welcome to attend, or details can be obtained from the club secretary on Dubbo 82 3574.

Members of the club express special thanks to Constable First Class, John MacLean and Constable Mike Todd for their help in getting the club settled in the new premises. Also to Senior Constable Greg Gibbs of the Police Radio Branch for his help and advice.

IONOSPHERIC PREDICTIONS FOR NOVEMBER

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). They have been prepared for the three most popular amateur bands over a number of interstate and international circuits. Black bands indicate periods when circuit is open. **11.73**



Maitland Radio Club

Four members recently qualified for the higher level YRCS certificates. Mr D. Jeanes, VK2BSJ, official examiner for the intermediate and senior YRCS certificates in NSW, congratulated the MRC for the continued high standard of passes in these and other grades. The club has again set a standard unequalled in the State.

In the senior radio certificate grade, Phillip Ellicott gained honours and Chris Dugan, a pass. In the intermediate radio certificate, Phillip Sciffer and Ian Lawrence both gained credit passes.

In September 1970, work commenced on the MRC theatrette and it was officially opened in February 1971. Since then the building has been used each week for classes, visual aid training, film evenings, presentation evenings, Christmas parties, stage shows and meetings. Other clubs and organisations have hired it for their own film evenings.

However, one of the greatest assets has been the technical interest for those who installed equipment, and worked at improving systems and facilities.

A complete 150 watt AM transmitter has been donated by Mr W. Jenvey, VK2ZO. This will complete the transmitter room installations. It will be used to train students for the senior YRCS certificates and the PMG's Department AOCP examinations. It will also be used for the YRCS news broadcasts on Saturday afternoons. Mr K. Watson, VK2BLW, MRC president, said the gift has put the club months ahead with its plans to equip the station.

ACT DIVISION FORMED

An important WIA event occurred on Monday, 23rd July, 1973. Following a decade of planning and negotiations, the first general meeting of the WIA ACT Division Inc was held. It is expected that, in the very near future, this newly formed body will be given full division status.

The move arose from the desire of the Canberra Radio Society, and ACT amateurs generally, to have indepent WIA representation. Formerly the ACT (VK1 call area) was part of the NSW division (VK2 call area). It has been the policy of the NSW division to support the VK1 move since 1962, when the proposal was first submitted to a WIA federal convention.

More than 50 persons attended the meeting. The result of the elections for officers was:

President	John Lauten	VK1JL
Senior vice-president	Ted Pearce	VK1AOP
Vice-president	Steve Grimsley	VK1VK
Treasurer	John Roberts	VK1ZAR
Secretary	Andrew Davis	VK1DA

BOOKS & LITERATURE

Amateur VHF projects

VHF PROJECTS FOR AMATEUR AND EXPERIMENTER, by Wayne Green. Published by Tab Books, Blue Ridge Summit, Pa, USA, First edition 1972, No 608 of a series. Soft covers, 136 x 214mm, 224pp, many pictures and diagrams. Price in Australia $6.15.

This book is a compilation of selected articles and projects from "73" magazine, over the last few years. All the projects represent a useful piece of equipment in the VHF field. Some are simple, some more complex. The intention is to interest novice and low frequency operators, but there is something there for more experienced operators and those already active on VHF as well.

The equipment covered ranges from converters and receivers to transmitters and aerials, control units, test gear and complete stations, for the 50, 144 and 220MHz bands. There is something for the mobile operator and numerous items on suitable mobile and portable equipment.

The book describes 61 different projects, each treated separately and generally well illustrated with pictures and circuits. It contains the sort of information useful for "contemplating and comparing". It's very handy to have it all, so diversified, in one book.

In short, a book which could well occupy a space in any VHF operator's bookshelf, if only for reference.

The review copy came from the Grenville Publishing Co, who advise that copies should be available from all major bookshops. (F.J.S.)

Colour Television Course

BASIC COLOUR TELEVISION COURSE, by Stan Prentiss. Published by Tab Books, Blue Ridge Summit, Pennsylvania, USA. First edition, No 601 of a series. Soft covers, 140 x 218mm, 420pp, many pictures and circuits. Price in Australia $8.70 soft cover, $12.40 hard covers.

Beginning with an explanation of AM and FM modulation, the author then continues in technician style. The passage of the TV signal from the origin at the camera, through the transmitting equipment, antenna, and the reception is covered, stage by stage through the receiver. Of necessity, the explanation is kept to essentials, but covers the functions performed in the demodulation process. References are made to many well-known brands of colour TV receivers on the American market.

The system which prevails is NTSC but a small chapter outlines the PAL and SECAM systems as "Foreign" systems. One chapter deals with CATV systems and this will be of interest to many readers.

At the end of each chapter a number of questions are provided to check the reader's understanding and attention. Answers are also provided in the answer section at the end of the book.

The chapter headings are as follows: 1 — The complete colour system, 2 — Colorimetry and picture tubes, 3 — Receiver adjustments, 4 — Purity, grey scale and convergence procedures, 5 — Tuners, video IFs and AFTs, 6 — Video amplifiers and audio systems, 7 — Sync and AGC circuits, 8 — Vertical deflection systems, 9 — Horizontal deflections systems, 10 — HV supplies and pin cushion circuits, 11 — Low voltage power supplies, 12 — Chroma circuits, 13 — Transmission lines and antenna systems, 14 — Trouble shooting, 15 — Domestic CATV systems, 16 — Foreign systems. An answer section is provided followed by a 6-page index.

Chapter 13 provides some very practical information on transmission lines and the general techniques involved with trap circuits and matching procedures.

The review copy came from the local office of the publisher who advises that copies should be available from all large bookstores. (F.J.S.)

Colour TV Servicing

199 COLOUR TV TROUBLES & SOLUTIONS, first edition 1972, by R. L. Goodman. Published by Tab Books, Blue Ridge Summit, Pa, USA. No 595 of a series. Soft covers, 218 x 138 mm, 224pp, many circuit diagrams. Price in Australia $6.15 soft cover, $9.95 hard covers.

This is a book designed for the service technician who is looking for answers to problems, in the shortest time. Written in a case history style of presentation, the author has provided the symptoms, the answer, and the reason for failure, in a large number of receiver models from seven well-known American set manufacturers.

A lot of the information has been gleaned from the manufacturers' notes, or service notes, on particular types, and reads along the lines "After such a serial number, item A was replaced with item B on certain models." This is all very valid and valuable information to the serviceman, to whom, generally, "time means money." But unfortunately the receivers are all American types, using the NTSC colour system, and a number of the faults and remedies will not apply to Australian conditions.

As an insight into the problems experienced in the colour TV servicing business, however, it makes good reading. At this stage of "going to colour," many servicemen will probably welcome such an array of information, so specifically documented, without any frills.

199 case histories are presented, generally one per page, but with the shorter ones, two per page. They cover the range of

faults commencing with 1: Admiral Colour Monitor — No colour; through 28: GE, C2 — Arcing, streaks across picture; and 50: Magnavox — Failure of colour detector diodes; 122: RCA CTC27x — Gray-scale shift; to 199: Lots of snow on screen. One section particularly intrigued the reviewer — 198: All brands of colour receivers — Intermittent circuit connections and circuit board leakage. That one could cover a lot of problems.

The review copy came from the local agent Grenville Publishing Co Pty Ltd, who advise that supplies should be available from all large bookstores. (F.J.S.)

A.C.E. RADIO

AMPLIFICATION · COMMUNICATION · ELECTRONICS

★★★★★★★★★★★★★★★★★★★★

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KAISE
MODEL SK-100

VOLT-OHM-MILLIAMMETER

HIGH SENSITIVITY
100,000 Ohms per Volt DC
10,000 Ohms per Volt AC

SPECIFICATIONS:

- DC Volts: 0.6, 3, 12, 60, 300, 600, 1200.
- AC Volts: 6, 30, 120, 300, 1200.
- DC Current: 12uA, 300uA, 6mA, 60mA, 600mA, 12A.
- AC Current: 12A.
- Resistance: 20K ohms, 200K ohms, 2M ohms, 20M ohms.
- Decibels: Minus 20 to plus 17, 31, 43, 51, 63.
- Accuracy: DC plus minus 3pc, AC plus minus 4pc (of full scale).
- Overload Protected by dual silicondiodes.
- Double jewelled plus minus 2pc Meter.
- Plus minus 1pc temperature stabilised film resistors.
- Polarity changeover switch.
- Scale with mirror.

Price $34.75

Post 75c. Interstate $1.00.

MODEL SK-20
20K OHMS PER VOLT DC
10K OHMS PER VOLT AC

SPECIFICATIONS:
DC Volts: 0.25, 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 1000.
DC Current: 50uA, 25mA, 250mA.
Resistance: 7K, 700K, 7 Meg.
Decibels: Minus 10 cps plus 22 (at AC 10V) plus 20 cps plus 36 (at AC 50V).
Upper freq. limit 7 Kc.
OVERLOAD PROTECTION
$13.50

MODEL SK-44
30K OHMS PER VOLT DC
10K OHMS PER VOLT AC

Specifications:
DC Volts: 0.6, 3, 12, 60, 300, 600, 1200, 3000.
AC Volts: 6, 30, 120, 300, 1200.
DC Current: 30uA, 6mA, 60mA, 600mA.
Resistance: 10K ohms, 1 M ohms, 10 M ohms, 100 M.
Decibels 20 cps plus 17, 31, 43, 57, 63.
OVERLOAD PROTECTION.
SPECIFICATIONS
Post 50c Interstate 75c.
$19.25

MODEL SK-140
20K OHMS PER VOLT DC
10K OHMS PER VOLT AC

SPECIFICATIONS:
DC Volts: 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 25mA, 250mA.
Resistance: 40K, 4 Meg.
Decibels: Minus 20 db cps plus 62db
$11.95
Post 50c, Interstate 75c

MODEL SK-7
4K Ohms per Volt DC
2K Ohms per Volt AC

SPECIFICATIONS:
DC Volts: 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
D.C. Current: 250uA, 10mA, 250mA.
Resistance: 20K (x10) 2 meg (x1000).
Decibels: 2db cps plus 62db.
$9.75.
Post 50c, Interstate 75c.

BENDIX BC-221

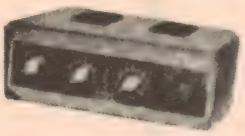
Frequency Meter. 125Hz — 20 MHz. Complete with Calibration Book and 1000Hz Crystal. Good order. **$35.00.**

EX-DISPOSALS RADIO EQUIPMENT TO CLEAR AT BARGAIN PRICES.

FIS

522 TXRX 100-150 mcs	$17.50
TR 1934 TXRX 100-125 mcs	$12.50
TR1935 TXRX 100-155 mcs	$17.50
3" Indicator Receiver Unit type APN — 93API Cro-plus 33 useful Valves.	$15.00
AWA R-F signal generator 140-300 MHz	$40.00
AWA harmonic generator with xtals. Type 10A 50065	$35.00
AWA time base marker generator, type A51940	$20.00
Electro statio voltmeter, 0-5000 V	$30.00
AR7 receiver with S meter and valves but no coil boxes or supple	$20.00
Multi strand PVC covered cable, 7 core, per yd	.15
14 core, per yd	.35
Twin shielder PVC, fabric cover, per 10 yds	.90
Single core shielded cable per 10 yds	.75
Command transmitters	$7.50
12 volt solenoid relay. 4 change over, 10 AMP contacts	$1.50
5 digit counter relays, 500 OHM	$1.00
3" flush mt. panel meter, 0-50 MA	$2.00
3" S meter 0-1 MA	$2.75
Dynamic headphone and mkc. 50 ohms	$2.50
Mini battery operated motors 1½-3 volts. Each	.50
Box of ten	$3.50
1 meg. W/W 1% resistors. 5 for	$2.00
Projector lamp GE type DFR. 120V-500 Watts	$2.90
New 2½" square clear plastic panel meters 0-12VDC, and 0-24VDC.	$2.50
50V AC 50Hz 3" Selsyn motors	$2.50
APX-6 Transponder	$15.95
ARC-5 2 metre Transmitters	$18.95

P.A. AMPLIFIERS



Rugged and dependable — standard valve circuitry. Two Hi-Imp inputs suits either mic. or PU. Each input has s separate volume control, which enables electronic mixing — Bass Treble tone control. Amplifiers available with multi-tapped line matchings (66. 100. 125. 250. 600 ohms). On ordering please stipulate the matchings required.
Operation 240 VAC 50Hz

4 Ratings available.

15 Watts rms	$53.50
30 Watts rms	$63.50
40 Watts rms	$89.50
60 Watts rms	$139.00

E.A. PROJECTS

21 Watt PA Amplifier June '72 Kit	$57.00
Constructed Ready for use	$67.00
PM 135 PA Amp Aug '72 Kit	$47.50
Wired & Tested	$57.50
21 Watt Guitar Amp Oct '72 Kit	$49.00
Wired & Tested	$59.00

P.A. SPEAKERS 8 WATT

8 in units in waterproof projection horns.
15-Ohm voice coils
Price $18.95

MICROPHONE STANDS

Floor Model 6ft adjustable with heavy weight cast iron base.
$12.75

Goose necks 12"	$3.95
18"	$4.95
24"	$6.00

B.S.R. STEREO MINI-CHANGER

240V AC 50Hz. 3 speeds. Complete with ceramic cartridge. $19.50, p & p $1.50.

P.A. SPEAKER COLUMNS

Good frequency response, top quality reproduction two models available. The **45 Watts** RMS has four 8" heavy duty speakers. Cabinet size 37" x 11½" x 10½". **$49.50.** The **25 Watts** RMS has four 6" heavy duty speakers. Cabinet size 33" x 10" x 10" **$37.50.**
The columns are suitable for indoor or outdoor use — floor or wall mounting. Cabinets are covered with black vinyl. Imp 8 or 16 ohms.

CABLE

Twin speaker Flex. **$5.50** per 100 yds. P & P 70c. Low loss Mic cable. Single core **15c** per yd. Twin core **25c** per yd.

VTVM MODEL TE-40 MILLIVOLTMETER

Spec: AC V, 1mV — 300V RMS, 10 ranges. Accuracy, SHz to 1.2MHz plus or minus 2dB 10Hz to 1.0MHz plus or minus 1dB, 20Hz to 250KHz plus or minus 0.2dB.
dB Scale: 40-30-20-10-0-10-20-30-40 50dBm. 240V AC.

$42.95

MODEL TE-65 V.T.V.M.

DC V 0.1, 5.5, 15 50, 500, 1,500 V Rms. ACV 0.15, 5.5, 15, 50, 150, 500, 1,500 V Rms 0.4, 4.4, 14, 400, 1,400, 4,000 V PP Resistance: RX10, 100.1K, .10K, 100K, 1M, 10M, Decibel — 100dB minus plus 65 dB.

240 VAC
$43.75

NEW POWER TRANSFORMERS TO CLEAR AT SALE PRICES

Primary input of all types is 240V AC 50Hz.

360-0-360V 275MA. 25-0-25. 6.3V.3A. 6.3V.6A. 6.3V 2A. 6.3V CT. 4.2A. 12V CT.6A	$7.50
220-0-220V 150mA. 6.3V CT. 2.7A. 6.3V.2.1A 5V.6A	$6.50
215-0-215V. 100mA. 6.3V CT. 3.6A. 6.3V. 1.8A. 2 x 5V. 0.3A 5V 2 Amp.	$4.95
220-0-220V 80mA. 6.3V CT. 2.1A. 6.3V. 2.1A. 5V. 6A	$4.00
207-0-207V 245mA 6V-4A. 6.3V. 3.2A 5V.2A. 5V. .3A	$5.50
230-0-230 80mA 210-0-210 26.3 bias 6V.5A	$4.00
385-0-385 80mA Standard 6.3V and 5V Fils	$3.00

Package and post on above transformers: NSW $1.00, Interstate $1.50.

240 / 240V 60mA Isolation Transformer	$4.75
220-0-220V 50mA 6.3V2A	$3.50
22-0-22V 1A 6.3V 0.2A	$3.50
0-50V. 1.5A 0-15V. 1.5A	$5.75

RADIO VALVES

Never to be offered again at these prices. Any 10 of the following valves $3.00 + 75c p. & p. 1H4, 1H5, 1Q5, 1J6, 1A7, 1C5, 1A5, 1K5, 1C7, 1K7, 1C4, 1K6, 1G4, 12AN7, 1L4, 3Q4, 3A4, 9006, 6X4, 6C4, EA76, 6N7, 6X5, 6SC7, 6L7, 6R7, 6C8, 6B6, 6A6, 6SF5, 6SF7, 6AG7, 6BL7, 6Q7G, 65J7, 6SS7, 6SH7, 6AC7, 6SA7, 6J7G, 6K7G, 6F6G, 6K8G, EMI EF36, EF37, EF39, EL32, EK32, EN92, X65, X66, KT32, 956, 884, 12AH7, 12SL7, 12SH7, 12C8, 12A6, 12SJ7, 25L6, 6AN5, 6AL5.
Any 10 of the following valves $4.60 + 75c p. & p. 6AQ8, 6AM5, 6AM6, 6AJ5, 6AR5, 5MK9, 6AV6, 6BA6, 6ME5, 6BD6, 6AD4, 6BA5, 6BF6, 6J6, 12AT7, 1S5.
Any 10 of the following valves $6.95 + 75c p. & p. 1T4, 1R5, 6AK5, 6L6G, 6AR6, 6B4, 2E24, 12BE6, 6F6, 6E5, VT52, 1629, 1625, 807, 76, 6K6.
The following at $1.00 each. 19, 36, 37, 38, 45, 47, 53, 77, 6F7, 6A4, 1F5, 6BQ7, 7C5, 1904, 13E1, 6L6, ECH35, VR57, X61M, 866 866A.
The following $1.50 each. 5AR4, 5R4GY, TZ40, 211, 221H, CV415, 6G8.
The following at $3.00 each. 832A, 3E29, 6DQ5, 803, 726 Klystron. P. & p. 50c.

50 WATT SOLID STATE GUITAR AMPLIFIER

50 watts RMS solid-state guitar amplifier. PM125 4 inputs, 2 channel with separate volume, bass and treble controls; speed and intensity controls for vibrato. Remote foot switch with plug and lead. Black vynex carry cabinet.

Fully constructed and ready for operation off 240VAC $125.50

GUITAR SPEAKER CABINET

Upright floor model, black vynex covering, 34" x 18" x 12", sloping front, contains innerbond packing and two Rola 12u50 12" speakers.

$115.00

15" PIONEER

15in Pioneer low frequency speaker, imp 16 ohms. Power, 30 watts RMS designed especially for use with bass guitar or electric organ. Also ideal for stereo woofer speaker.

$33.00

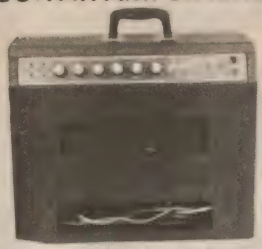
ROLA 50 Watts R.M.S. LOUDSPEAKERS

Model 12U50 Bass $35.00

Model 12UX50 Extended Frequency $40.00

P&P $1.50

SONATA GUITAR AMPLIFIERS



2 channels, 4 hi-imp inputs, 2 separate volume controls — separate bass and treble controls, speed and intensity controls for vibrato (tremolo) with remote foot switch with plug & lead. Attractive black vinyl covered carry cabinet.

8" heavy duty speakers

20 watts RMS $93.00 35 watts RMS $129.00

B.S.R. STEREO RECORD PLAYER

Model P-128. Latest design. 4-speed. Auto or manual operation. 11" heavyweight diecast turntable driven by fully shielded 4-Pole dynamically balanced 240V motor. Noise suppressor. Silicone damped cueing device. Square section brushed aluminium pick up arm. Adjustable counterbalance. Calibrated stylus pressure control. Antiskate bias compensator fitted with magnetic cartridge. Diamond stylus, also audio leads. The player is supplied complete with hinged Perspex cover. Limited stocks only. $69.75, p & p $2.50 NSW. $3.50 Interstate.

OVAL SPEAKERS

9" x 6" 3,5,8 or 15 OHMS	$6.95
7" x 5" 8 or 15 OHMS	$5.75
6" x 4" 8 or 15 OHMS	$4.75
6" x 2" 8 or 15 OHMS	$4.25
5" x 3" 8 or 15 OHMS	$3.75
4" x 2" 8 or 15 OHMS	$3.50

STEREO RECORD CHANGERS

C129 — C141 — C142 — C142A3

Current models, 4 speeds, automatic or manual operation.

Ceramic cartridge, Sapphire stylus Standard model with 12in turntable. $34.00

Deluxe model with 12in turntable, Cueing device, ceramic cartridge, diamond stylus $40.00

Deluxe model as above with an adjustable counter balance, 2 spindles, calibrated stylus pressure control added $46.50

Deluxe model as above with 12in Diecast Heavyweight turntable, 4-pole shielded motor, suitable for Magnetic cartridge $56.50

The latter two record changers can be supplied with magnetic cartridge and diamond stylus at $10 extra.

PERSPEX COVER

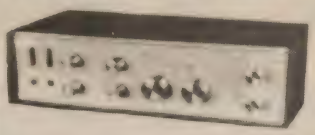
Smoke Tinter 17¼" x 13⅛" x 4½" $9.00. P & P 60c

Pre Cut Mounting Platform Teak and Walnut 18¼" x 15" x 3½" $11.50. P & P 75c.

Top Quality padded stereo phones

8 OHMS. De luxe models. 18-20000Hz. ½ watt with slide V-controls $12.50. With Rotary V-controls $11.90. Standard Model 20-12000Hz $4.70. Pack and post 65c. All are complete with retractable cord and stereo 6.5mm plug. Famous ZENNHEISER HD414 $25.95.

SONATA NS-1600D



All silicon solid state Hi-Fi Stereo Amplifier. 10 watts RMS per channel. Each channel has separate Bass Treble controls. Inputs for magnetic or ceramic cartridge, crystal mic., radio, tape — tape out; stereo headphones. 8 — 16 Ohms. Instruction booklet, circuit supplied. Timber cabinet. Dimensions 14½" x 8" x 4"

$67.50 Plus Freight $2.50

GARRARD

MODEL SP 25MK III 3 Speed. 4 pole motor. Aluminium turntable. Fully balanced & CALIBRATED P.U. arm. Bias comp. cue & pause control. Click suppressor. Auto. Set down. Excluding cartridge $55.80. P & P $1.50. Also available.

Garrard Zero 100 $177.80.

Garrard SL72B $97.00.

Mounting base with perspex cover $23.80.

Dual 1214 $88.00.

Dual 1216 $110.00.

Dual 1218 $140.00.

Mounting base & cover $29.00.

Cartridge not included mag cartridge available to suit all models. Extra $10.00. Send S.A.E. for specs any model.

M.S.P. —A.W.A. SPEAKERS

Latest models 8 or 16 Ohms.

LF-6WAC-6½" bass. 35-6000Hz 16 Watts R.M.S. $10.50

6 WACX — 6½" twin. 40-16000 Hz 16 Watts R.M.S. $11.50

HF-2MBC Curvilinear cone tweeter 5000-20000Hz 20 Watts $4.50

HF-4MBC C-C tweeter, 2000-18000Hz 20 Watts $4.95

8TAC-8" heavy duty P.A. 14 Watts R.M.S. 40-8000Hz. $7.95

8TACX-8" twin, 14W R.M.S. 35-16000Hz. $9.75

LF12UA — 12" bass, 30W R.M.S. 30-7000Hz $19.90

12UACX 12" twin 25W R.M.S. 30-12000Hz $22.95

12PQC 12" bass 50HZ resonance, 30 W R.M.S. 40-5500Hz $22.95

Post and Package 75c NSW, Interstate $1.00.

PLAYMASTER 136 STEREO AMPLIFIER

As per Dec 72 E A

Full kit including fairchild transistors $62.50

Fully constructed and tested $75.00

Metal work only $7.65

P.C. boards $8.00

REVERBERATION UNITS

Freq. response. 60-3000 Hz. Decay time 1.5 seconds. Dimensions 4¾ in x ⅜in x 1¾in

$6.95 P & P 50c

CAR CARTRIDGE STEREO PLAYER

Separate controls

Complete with speakers

12v $59.95 P&P 90c.

240V AC — 6V DC CASSETTE TAPE RECORDER

2 track mono tape speed 4.75 CM. S. Power output 500MW, freq. response 150-7500 cps. DC BIAS, DC erasure complete with mic. Batteries, tape, top quality reproduction $45.95 P&P 75c.

STEREO RECORD PLAYER

240V AC — 4 speeds, ceramic cartridge. Separate motor, 7in turntable, pickup arm and rest. Post 50c.

$7.90

MAGNAVOX WIDE RANGE TWIN-CONE SPEAKERS

8 — 16 OHMS 30 - 16,000 Hz

6WR MK5 12 W RMS $9.90

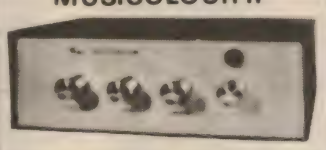
8WR MK5 16 W RMS $10.75

10WR MK5 16 W RMS $11.50

12WR MK5 16 W RMS $12.50

Pack and Post 65c.

MUSICOLOUR II



As per E.A. Dec. '71, Jan. '72. Complete kits of parts $49.50

Fully constructed $59.50

Pack & post 75c

P.C. BOARD ONLY $3.25

SPECIFIED TRANSFORMER ONLY $4.35

SOLDERING IRON

240V AC 30 watts. Lightweight 2¹₂oz Heating time 1.8 mins

$7.75.

CAR SPEAKERS

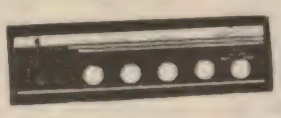
4 or 8 OHMS. Suitable for radio cassette or cartridge $7.75 EA $15.00 Pair. P & P 75c

CAR STEREO CASSETTE TAPE PLAYER

3 watts per CH freq. response 50-10,000 Hz sig to noise 40dB. Wow & flutter 0.25% WRMS 12 volts neg. earth. Complete with speakers size 50mm H. 152mm W 175mm D.

TOP QUALITY ASSURED $83.95 P&P 90c.

Sonata NS — 1600



All Silicon Solid State Stereo Amplifier 240V AC powered 8 watts RMS per channel inputs for magnetic ceramic, and crystal cartridge, also recorder and radio tuner, Hi-Fi frequency response speaker matching 4-16 ohms. Size 10½in x 6½in.

Attractive oiled teak cabinet.

Price $54.00.

P & P $1.50, Interstate $2.50.

Rotating Distress Emergency Beam

Fire Brigades and Rescue squads use them. So do Car, Truck and BOAT OWNERS WHO VALUE THEIR SAFETY. At home on party nights, have a light show. Red, Blue, Amber — visibility ½ mile. 12v DC 1 amp operation, waterproof. Complete with heavy duty suction cap. Size 3½" dia. x 5½" $5.75. Pack and post 35c.

DIECAST BOXES

7⅜" L	7⅜" W	2⅜" D	$5.75
7¼"	4½"	3"	5.40
7¼"	4½"	2"	3.45
4½"	3½"	2"	2.55
4¼"	2¼"	1"	2.20
3⅜"	1½"	1¼"	1.95

Pack and Post 65c.

PHILIPS

Model AD 0160 T8 1" Dome Tweeter, $10.00 P & P 50c.

MAGNAVOX 8/30 SYSTEM TEAK OR WALNUT

1.6 cft complete $58.00 ea.

8.30 Speaker $16.50 ea

3TC $3.40 ea

Fully built cabinet $32.00 ea.

Cabinet kit $22.00 ea

MULLARD MAGNAVOX BOOKSHELF SYSTEM TEAK OR WALNUT

6WR MK5-3TC 8 or 16 ohms 15½ x 8½ x 8½ complete

$31.50 ea.

Cabinet only $13.90.

THE "SATELLITE" INTERCOM SYSTEM

Figure 1. The two units comprising the "Satellite" intercom. The slave station is on the left, the master station on the right.

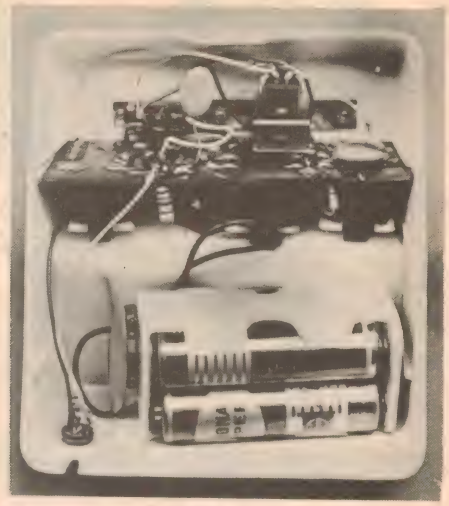


Figure 2. A view of the inside of the master station.

Transistors have made it possible to produce amplifiers which are both simple and inexpensive to operate.

A simple two-way intercom consists of a loudspeaker at one end, an amplifier, and a loudspeaker at the other end — all three components being made to do "double duty" by a suitable switching arrangement (figure 2).

One end, called the "master station", controls the input to the amplifier, usually through a switch which must be held down while the user is talking. This switch automatically returns to the "Listen" position

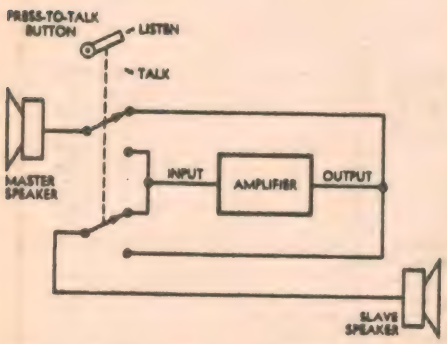


Figure 3. How the "Press to Talk" button on an intercom reverses the input and output of the amplifier.

when released; the master station then receives any sound from the other end, called the "slave station", whether the slave station wants to be heard or not. A basic intercom such as this is most useful for monitoring applications, such as in a small child's bedroom or a front door monitor, where no control at the slave station is desired. The power to the amplifier is also controlled only at the master station.

If we wish to have true two-way communication we must make provision for the user at the slave station to switch on the system and initiate a conversation, or at least to be able to signal the master station that he wishes to talk. This is done in a variety of ways in commercial intercoms; some have "Push to Talk" buttons on the slave stations; some have push-button tone signals or buzzers.

In business and factory situations, some intercom systems have a dozen or more slave stations communicating with a large master station that can select and control the others.

The master station must, of course, have switching facilities to control flow of traffic into the amplifier to prevent the amplifier from being presented with more than one signal at a time.

Simple battery operated intercoms with solid-state circuits are now mass produced so inexpensively that the hobbyist can buy one for less than it costs to build one. The cheaper units are less robust and have less power output than more ambitious designs, but are adequate for a home or quiet office.

Those of you who would like to build your own will find an easy-to-build transistorised intercom project in the August, 1971, issue of "Electronics Australia".

For those of you who would rather buy and install an inexpensive commercial intercom we will give you a few helpful hints here on how to install a typical unit.

The unit chosen for demonstration purposes is a small plastic-cased intercom named the "Satellite", which is sold by Radio House Pty Ltd. of Pitt St., Sydney. This unit, which sells for $10.50, has a four-transistor amplifier with the output stage transformer-coupled to the speakers.

The slave station has no provision for turning on the amplifier. Instead, the slave station contains a pushbutton labelled "Push-to-Call" which causes the amplifier circuit to oscillate and produce a steady tone from the master station loudspeaker. This signal tone operates only when the power switch on the master station is in the OFF position.

If the master station power switch is in the ON position, the slave station can make contact by a voice call, since the master can hear the slave station any time the power is on, except when he is actually talking with the "Push-to-Talk" button pressed.

Note that this means the slave station has no privacy with this type of intercom, because the master station can turn on the power at any time and listen in. There is no provision for the slave station to turn the power off.

The master station user also has a choice of two signal methods. With the power switch off, a tone is produced when the "Push-to-Talk" button is pressed; with the power switch on, the normal voice call can be made.

The Satellite intercom is easy to install; no knowledge of electronics is required. It comes complete with a length of lightweight two-wire cable which must be plugged into each case.

A slotted hole is provided at the back of each case so the unit can be hung over a nail or screw head for wall mounting. If the interconnecting cable is to be run to an outside garage or workshop location it would be advisable to use a heavier cable with a waterproof outer covering. Almost any easily available cable will do the job.

PRICE . . . $10.50

Complete.

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With wires & batteries.

INFORMATION CENTRE

DATA SHEETS: Could you tell me where to get a comprehensive data book about transistors, diodes, ICs, etc. I am new to this hobby and the type numbers tell me nothing as to the nature of the device, its intended use, ratings, etc.

Your problem is not unusual. Most beginners are similarly confused. Unfortunately, there is no readily available comprehensive data book such as you envisage. The best solution is to approach individual manufacturers, who normally issue data sheets or books covering their own products. The simplest sheets may be issued free, but more comprehensive booklets and books may cost anything from 50c to several dollars. With a little patience you can build a comprehensive library and also learn to recognise the origin of individual units by their type number.

COLOUR TV: I have a number of queries relating to colour TV. (1) Exactly which type of colour system is being introduced here? I am still not sure. (2) In which countries is this system in use at present? (3) If I were to acquire a set from one of these countries would the picture rate, station frequencies, etc, suit the Australian system? (4) Just what is this "chroma-lock" gadget? The popular press have to be out of their minds when they claim it will give colour pictures on a monochrome set, but what is it?

Taking your questions in turn (1) Australia has adopted the PAL colour TV system. (2) This is being used in Britain and most of Europe, except France and the USSR. (3) A very definite NO. Our advice to anyone contemplating buying an overseas colour TV set in anticipation of Australia's colour TV service is DON'T. Channel frequencies and video/sound frequency separations are two of the characteristics most likely to differ from ours. (4) The chroma-lock circuit was originally devised as a refinement for the PAL receiver. It removes the one remaining fault (slight loss of colour saturation) which results from differential phase distortion. In the NTSC system differential phase distortion causes serious change of hue (colour). When fitted with a chroma-lock circuit PAL receivers are classified as "perfect PAL."

We don't know whether the popular press are "out of their minds" but we would agree that they have not done their homework. This matter was covered in detail in "Forum" in the October issue.

REGENERATIVE TUNING STABILITY: In a regenerative tuning circuit I have noticed that adjusting the regeneration alters the tuning considerably on short-waves. How can I reduce this problem? How can I make an RF oscillator stronger without the tendency for instability? (T.C., Burnie, Tas).

Interaction between regeneration and tuning controls is a common problem, particularly where the regeneration control is a variable capacitor directly in the feedback circuit. This latter is coupled to the tuning circuit. Circuits using a variable resistor to control the feedback are generally better in this regard. One of the arrangements most favoured in bygone years employed a pentode valve as the detector, a fixed amount of feedback coupling, and a pot which varied the screen voltage to control regeneration. This overcomes this problem very well, but the fixed amount of feedback must be carefully adjusted to ensure that adequate screen voltage is present before regeneration occurs. Otherwise the gain of the system will be adversely affected.

Your other question, unfortunately, is rather too vague for us to be able to answer. We would need to know a lot more about the circuits involved before we could comment.

VINTAGE RECEIVER CIRCUITS: Occasionally, in the Information Centre columns, requests are made for circuits of vintage receivers. I have a number of copies of the "Australian Official Radio Service Manual," except volumes 6, 9, 10 and 11, and would be willing to oblige readers in need, if the information is available in the volumes on hand. The stipulations are that enquiries should be from bona-fide hobbyists, and accompanied by a stamped addressed envelope plus a 7 cent stamp to cover cost of copying. It will be necessary for the enquirer to supply some definite means of identifying the receiver circuit, preferably with the model number which is sometimes part of the serial number, generally stamped on the rear of the chassis. Any reference to the ARTS & P sticker sometimes found on these chassis, is useless.

If some reader has copies of Volumes 6, 9, 10 and 11, mentioned previously, I would be very pleased to make a nominal offer for them if they would please contact me at the address shown. All enquiries should be addressed to Mr J. H. Emery, 26 Ryrie Ave, Como, WA 6152.

Thank you Mr Emery for your kind offer. Readers in need of such services take note.

ELECTRONICS ON THE FARM: Regarding Mr Wahlquist's letter (p55 Oct 72) which discussed "Electronics on the Farm." I recall that I wrote in support of these ideas at the time, but it may be that we are the only two people interested in the subject.

I expect to settle on a small farm shortly, and the following would be the most useful aids that I can think of at the moment.

(1) Electric fence.
(2) Moisture meter, to indicate whether the soil is moist enough at 3ft down to permit sowing.
(3) Remote noise monitoring device for a hen shed to sound an alarm if the noise level rose above a certain value, indicating trouble.
(4) Remote water level indicators for tanks.
(5) An indicator of the amount of feed left in a bin. (A load cell under one support?)

I would like to see a "Farm Special" similar to the "Automotive Special" of a few years ago. This would undoubtedly stimulate further interest. (P.L., Nauru, Central Pacific).

Thank you for the suggestions, P.L. We doubt whether we could justify the time needed to develop these projects, in view of the rather limited interest. However, we have published your list of suggestions for the benefit of other readers. Some may have already developed some of these ideas, others may be encouraged to do so. We would be happy to publish any such ideas which have reasonable merit and, particularly, have been actually used in the intended role. The latter requirement may not be essential, but it is very desirable.

STYLUS NOISE: I have a commercial turntable and high quality stereo pickup. This setup works well except that the music on the record is still audible even when the amplifier is not on. What can I do to stop this, why does it do it, and is it gradually wrecking my records?

The effect you describe is perfectly normal. It is due simply to the stylus moving in the record groove. The only cure is to provide a cover for the turntable assembly. It does not indicate any damage being done to your records.

DRUM: Could you please tell me if you intend publishing a circuit for an electronic drum or rhythm unit. I am sure many musically minded readers would be interested. Of course speed, width and several different rhythms would be needed. Keep up the good work. (D. N. Westleigh, NSW).

An electronic drum was described in the May 1970 issue, under the title "Autodrum" (File No. 1/EM/24). While it does not provide all the features requested, it would be a good place to start experimenting. We have no other plans for musical instruments of this type at the moment.

KITS & PRICES: Re the "Simple Electronic Dice" (August 1973) project in Circuit and Design Ideas: Do you have the components in kit form, or do I have to buy them separately? How much do they cost, and what is the method of payment? (A.C. Mungindi, NSW).

We do not deal in components of any kind. Prices, specifications, etc, should be sought from appropriate advertisers or agents.

DEAD LETTER: A letter addressed to Mr R. Poster (Tester?), Student, Massey University, Palmerston North, New Zealand, has been returned marked "unclaimed." If the writer will contact us and provide a more complete address, we will forward the material to him.

Continued on page 125

HOW TO USE OUR INFORMATION SERVICES

As a service to readers "Electronics Australia" is able to offer: (1) Project reprints, metal work dyelines, photographs, printed wiring patterns and other filed material to do with constructional projects and (2). A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below:

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OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee and may be answered in the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

COMMERCIAL EQUIPMENT: "Electronics Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals equipment etc. We are therefore not in a position to comment on any aspect of such equipment.

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INFORMATION CENTRE

FREQUENCY MODULATION: After reading the series of articles on the "Climie Transceiver" (January 1973 to April 1973) I have become very interested in how FM works. I have even considered building a simpler type of arrangement. Where could I find a book or magazine describing how FM works. Also what is the operation of a squelch, mute, and AFC?

A detailed description of frequency modulation is outside the scope of this service. There should be a number of textbooks which would cover it, including the "Radio Amateur's Handbook" and the "Radio Communication Handbook." Both should be available at any large bookshop. Incidentally, we would advise against trying to produce any designs of your own until you have a much better grasp of fundamentals.

The terms "squelch" and "mute" generally mean the same thing: To desensitise the audio output when no signal is being received. AFC stands for automatic frequency control usually used to control the tuning of a receiver.

BROKEN FERRITE AERIAL RODS: What would be the effect of a broken ferrite rod in the aerial circuit of a portable receiver. Can you tell me the reason for synchronous and non synchronous vibrators used sometimes in car radios of a few years ago? Thirdly can you tell me the name of a good book on the subject of medical electronics. (N.D., Lithgow, NSW).

A broken ferrite rod would detune the aerial circuit. The effect would vary depending on the position of the break, but the end result would be a weaker signal. These rods can be repaired by binding with tape, or joined with epoxy cement. It is generally better to get a new rod if at all possible, but this will require retuning the circuit. Synchronous vibrators were introduced to eliminate the need for rectifiers in the power supply. Sorry N.D., you will have to consult the library or a good technical bookstore for the information you require on medical electronics.

MORSE PRACTICE: Can you tell me where I might be able to obtain records of morse code for practice reception? (R.C. Clontarf Beach, Qld).

We are not sure about records, R.C. but the Wireless Institute of Australia makes tapes available. Get in touch with the Queensland division of the WIA for more details.

SYNTHESISER: I'm interested in building an electronic music synthesiser of reasonable complexity, but under $1000. Preliminary research has shown the existence of a "mini moog" ($1495) as well as a couple of kits from England. Can you help me with information or people to contact? Is there any chance of a synthesiser appearing in EA over a few months? (.G., Brookfield, Qld).

Unfortunately, no to both questions. There is almost no chance in the foreseeable future of we ourselves describing a synthesiser as a project — we feel that it is too much for the average home constructor to tackle at the present state of the art. Of course, this may change in time. We do not know of any source of such instruments in Australia — particularly under $1000.

ELECTRONIC ORGANS: In the August issue, a correspondent identified as "R.B." of Freemans Reach, NSW asked for a circuit for an electronic organ. Please publish my address, as I will be happy to supply him with suitable information. (Mr J. B. Lensink, 155 Sampson Rd, Elizabeth Grove, SA 5112).

We have published your address as requested, Mr Lensink, and hope that R.B. is able to take advantage of your generous offer.

NOTES & ERRATA

NOISE FILTER AND VOLUME COMPRESSOR: (September 1973, File No 1/M/16): The input capacitor to the base of Q3 should be 0.27uF. The voltmeter across the zener diode is 0-5V at 20k ohms per volt. If required it may be replaced with a 50k ohm resistor.

DIGITAL CLOCK ADDENDUM (Ausust 1973, File No 7CL/11): Mr P. Hardy of Woomera, South Australia advises that his suggested modification is not suitable for 24phour operation as the clock would reset to 01.00 after 24.59 instead resetting to 00.00 after 23.59. Therefore readers wanting 24-hour readout should wire the clock as indicated in the first article in June 1973. Note also that Figures 1 and 2 in the August article are transposed.

LSI DIGITAL CLOCK (September and October 1973, File No 7/CL/12): In the test and parts list, the Sperry gas readout is given the wrong part number. SP-51 refers to the 12-hour readout; SP-332 refers to the optional seconds readout.

HOMODYNE TUNER (July 1973, File No 2/TU/36): The by-pass capacitors at pin 6 and pin 4 of IC MC1330P, have been transposed on the PCB, 73/tu7 drawing page 35.

DIGI-METER (October 1973, File No.7/M/45): The price of $89 quoted for the AD2010/E digital panel meter does not include sales tax, which in most cases will be applicable. The appropriate sales tax is 15pc, which brings the price to $102. Due to a printer's error, the following section of text was omitted from the article. It should have appeared on p.32, in place of the text printed:

version of the uA7805 directly. The plastic-package version of the uA7805 can still be easily mounted using one of the same holes.

Assembly of the unit should be found quite straightforward if the photographs, circuit and wiring diagram are used as a guide. Note that the three 1k resistors used for decimal point blanking, together with the 4.7uF tantalum bypass capacitor, are mounted directly on the 30-pin connector at the rear of the AD2010/E. Similarly the fixed resistors of the input voltage divider system are all mounted directly on the range switch, together with the 47k resistor used to provide overload protection on the resistance ranges.

When the assembly and wiring are . . . . . .

AF GENERATOR from p.53

Finally, the designated transistors are catalogued by Fairchild Australia Ltd, among other possible suppliers. Other transistor combinations, such as the Fairchild complementary pair, type AY6108 to replace the BC107A and type AY6109 instead of 2N2905, will probably be satisfactory in this circuit but have not yet been tested.

A voltage and current analysis of the prototype is given in Table 2 for general guidance. Small variations can be expected in other instruments but large ones will indicate trouble.

SERVICEMAN from p.71

customer. He explained that they would have to use the power point switch until he obtained and fitted a replacement switch.

It was only after he had returned to the shop and had an opportunity to fiddle with a second set of the same model that the mystery was solved. The set used a push-pull type switch; the first one he had ever seen, or even heard of.

He finished the story with a chuckle.

"Oh, I managed to save face. I returned a couple of days later and went through the motions of 'fixing' the switch. Then I made a point of demonstrating that it was now working properly. In fact, what I was doing was showing the customer how it worked, without seeming to do so. I tell you, I felt a proper idiot, even though no one knew about it except myself."

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Two mechanical filters ensure maximum selectivity – large tuning and bandspread dials make accurate tuning certain. Other features include Product Detector for SSB reception; Automatic noise limiter; calibrated electrical bandspread; "S" meter and B.F.O.; 2 microvolts sensitivity for 10 dB S/N ratio. All for the suggested retail price of $191.00 FOR/FOA Sydney.

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But reel-to-reel quality is what you'll enjoy from TEAC's new A-450 cassette deck.

We call it the "Challenger." And we challenge you to tell the difference between it and reel-to-reel.

We've perfected our new deck to the point of keeping wow and flutter below 0.07%.

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The A-350 and A-250 are great. But our challenger is the A-450.

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